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Santa Clara Valley Water District

2010 GROUNDWATER QUALITY REPORT

Santa Clara Valley
Water District

2010 GROUNDWATER
QUALITY REPORT

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Executive Summary

Introduction

The Santa Clara Valley Water District (District) monitors groundwater quality in the Santa Clara and Llagas Subbasins in support of Board Water Supply Objective 2.1.1 which directs the District to: “Aggressively protect groundwater basins from the threat of contamination and maintain the groundwater basins for reliability.” Primary objectives of this monitoring are to evaluate groundwater quality against established water quality objectives and to provide information to protect the long-term viability of the resource.

The majority of wells within Santa Clara County produce high-quality water that meets drinking water standards. The primary exception is nitrate, which is elevated in a number of South County wells and continues to be a concern that the District and other agencies like the Regional Water Quality Control Boards are working to address. The continued District evaluation of regional groundwater quality and potential threats helps ensure that potential adverse impacts can be identified and appropriately addressed to support continued availability of high-quality groundwater.

This 2010 Groundwater Quality Report includes an evaluation of water quality data from 70 wells sampled by the District and 224 wells sampled by water suppliers during calendar year 2010. Unlike public water suppliers who sample for compliance purposes, the District monitors groundwater to assess regional conditions. This report includes the following information for each subbasin: general evaluation of water quality conditions; comparison of 2010 water quality data to drinking water standards and agricultural objectives; and analysis of water quality trends of nitrate, total dissolved solids, and chloride over the last 10 years. As the Santa Clara Subbasin and Llagas Subbasin have significant confining layers, data for these areas is also analyzed for both the shallow and principal aquifer zones.

Comparison to Drinking Water Standards

The 2010 median concentrations for common inorganic constituents are generally well below California Department of Public Health (CDPH) drinking water standards and Regional Water Quality Control Board agricultural water quality objectives for each subbasin and aquifer zone. The one notable exception is nitrate with the median concentration in the Llagas Subbasin shallow aquifer zone approaching the primary, health-based standard.

Table ES-1 summarizes which constituents were detected above primary, health-based standards (Maximum Contaminant Levels, or MCLs) in 2010. These consist of aluminum, nitrate, and perchlorate. For the wells analyzed in this report, primary drinking water standards were exceeded at the following percentage of wells tested: aluminum (<2%), nitrate (8%);and perchlorate (<2%). Detections above MCLs occurred at both monitoring wells and water supply wells.

Table ES-1. Wells with Constituents Exceeding Primary Drinking Water Standards in 2010

Subbasin	Study Area and Zone	Constituent	Notes
Santa Clara Subbasin	Santa Clara Plain Shallow Zone	--	None
	Santa Clara Plain Principal Zone	Aluminum Nitrate	Aluminum was detected above the MCL at two public water supply wells. Subsequent testing did not confirm the elevated level at one of the wells. Nitrate was detected above the MCL at one private water supply well used mostly for irrigation.
	Coyote Valley	Aluminum Nitrate	Aluminum was detected above the MCL at one public water supply well. Nitrate was detected above the MCL at 2 water supply wells (one public supply well and one private domestic supply well).
Llagas Subbasin	Shallow Zone	Nitrate	Nitrate was detected above the MCL at 8 monitoring wells and 2 private domestic supply wells.
	Principal Zone	Nitrate Perchlorate	Nitrate was detected above the MCL at 9 water supply wells (4 public). Perchlorate was detected above the MCL at 2 public water supply wells.

Note: Public water systems must meet drinking water standards. For constituents detected above primary drinking water standards, this may require blending or treatment by the water supplier prior to delivery to customers.

The following constituents were detected above secondary, aesthetic-based drinking water standards in 2010: total dissolved solids (TDS), specific conductance, manganese, iron, aluminum, chloride, turbidity, and color. For the wells analyzed in this report, secondary standards were exceeded at the following percentage of wells tested: TDS (19%), manganese (9.6%), specific conductance (17%), iron (11%), chloride (<1%), turbidity (<2%), aluminum (<2%), and color (<2%). It should be noted that the drinking water standards for some constituents, such as TDS, are given as a range by CDPH. For these constituents, the lowest value (recommended limit) was used in this analysis.

Elevated nitrate concentrations are an ongoing groundwater protection challenge in the Coyote Valley and Llagas Subbasin. The District has undertaken various efforts to define the extent and severity of nitrate contamination, identify potential sources, and reduce nitrate loading. Current efforts focus on the evaluation of nitrate data to assess hot spots and trends, public outreach, and collaboration with other agencies to increase water and nutrient use efficiency. Nitrate management strategies will also be evaluated as part of the regional salt and nutrient management plans, which are scheduled to be developed by 2014 in coordination with groundwater basin stakeholders.

The District also continues to monitor progress of the cleanup of the perchlorate plume in the Llagas Subbasin, which has impacted a number of private wells. A highway safety flare manufacturing facility operated in Morgan Hill from the 1950s to the mid-1990s. Due to onsite activities, perchlorate leached through the soil into groundwater over time, a condition that was first discovered in 2000 during investigation by a potential buyer. When the extent of contamination was defined, it became clear that hundreds of private wells and several municipal water wells were affected. At the urging of the District and the community, the Central Coast Regional Water Quality Board has taken timely action to ensure the contaminated groundwater is restored. As of March 2011, the responsible party is providing replacement water for 13 wells compared to 661 wells requiring replacement water in 2004. Groundwater remediation activities by the responsible party are ongoing.

Comparison to Agricultural Objectives

Comparison of 2010 data against the respective agricultural objectives in the Regional Water Quality Control Board Basin Plans indicates relatively few instances where constituents were detected above objectives for wells located in the Santa Clara Plain and Coyote Valley except for nitrate. In the Llagas Subbasin, five constituents were detected above established objectives including bicarbonate, chloride, specific conductance, nitrate, and sodium adsorption ratio (SAR). Of those constituents, the thresholds for specific conductance and bicarbonate are given as a range. 28% of wells tested for specific conductance exceeded the lowest threshold, which marks the beginning of increasing problems with regard to salinity. However, no wells exceeded the upper limit. The same is true of bicarbonate. No wells exceeded the upper limit at which point severe problems can be expected with regard to calcium carbonate deposits on fruit and leaves. District staff will continue to monitor potential changes in specific conductance and other constituents exceeding objectives.

Trend Analysis (2001-2010)

Trend analyses for TDS, chloride, and nitrate were conducted using ten years of data (2001-2010). Trend was analyzed at all wells having at least four results for a given constituent over the ten-year period, so the number of wells analyzed for trend varied by subbasin and aquifer zone. For all constituents and aquifer zones, the majority of wells do not indicate clear evidence of trend. There were upward trends for the following percentages of wells: nitrate (7%), TDS (3%), and chloride (2.5%). For the wells analyzed county-wide for trend, there were downward trends for the following percentages of wells: nitrate (11%), chloride (2.5%), and TDS (1%).

When trends were present within a given subbasin and aquifer zone, the number of wells showing either an increasing or decreasing trend was generally similar. The notable exception is nitrate within the principal zone of the Llagas Subbasin, which showed more wells with a downward trend (16 wells) than upward (6 wells).

Section 4 describes how trends varied by constituent, subbasin, and aquifer zone. In the Santa Clara Plain and Coyote Valley, the location of wells with detectable nitrate and chloride trends did not appear to be entirely random with certain areas marked by wells having generally consistent trend results. The District will evaluate potential causes for these apparent clusters, some of which are positive (decreasing trends) and others that may indicate a localized concern (increasing trends). In the Llagas Subbasin, no easily discernable pattern of nitrate trend results was evident while trends of TDS and chloride were too few in number to attempt to discern any pattern.

Summary

Analysis of 2010 groundwater quality data from monitoring performed by the District and water suppliers indicates that groundwater in Santa Clara County generally meets drinking water standards without additional treatment. The most notable water quality issues continue to be nitrate and perchlorate, primarily in the Llagas Subbasin. The trend analysis using data from 127 wells from 2001 to 2010 indicates that in the Llagas Subbasin, nitrate is decreasing in 15% of the wells, increasing in 6% of wells, and showing no trend in 79% of wells analyzed for trend.

In general, the Santa Clara Plain, Coyote Valley, and Llagas Subbasin produce high-quality water and the majority of wells meet drinking water standards without the need for treatment. However, the detections above drinking water standards noted in this report present a challenge to water suppliers and private well owners who may need to blend or treat the water prior to delivery or use.

The District will continue to collect and analyze groundwater quality data to characterize groundwater quality, determine the severity and extent of contamination, and evaluate changes in water quality over time to help ensure the groundwater subbasins are aggressively protected from the threat of contamination. Understanding the quality of groundwater and potential degradation or adverse trends allows the District to better understand individual threats and pursue appropriate action to protect groundwater quality. These actions may include:

- Performing additional analysis to determine possible causes and remedies to address potentially adverse conditions or trends.
- Conducting public outreach to raise awareness of groundwater protection.
- Coordinating with regulatory agencies to pursue the timely restoration of degraded groundwater.
- Developing strategies to address ongoing loading of salts and nutrients, like nitrate.
- Working with local cities and the county to ensure land use activities do not adversely impact groundwater resources.
- Efforts to influence statewide legislation and policy to ensure groundwater resources are aggressively protected.

1.0 Introduction

1.1 Background

The Santa Clara Valley Water District (District) monitors groundwater quality as part of its groundwater management activities in support of Board Water Supply Goal 2.1: *"Current and future water supply for municipalities, industries, agriculture and the environment is reliable"* and the related Water Supply Objective 2.1.1: *"Aggressively protect groundwater basins from the threat of contamination and maintain the groundwater basins for reliability."*

The overall objectives of groundwater quality monitoring are to evaluate groundwater quality against established water quality objectives and to provide information to protect the long-term viability of the resource. Specific goals of the groundwater quality monitoring program are to: 1) characterize regional groundwater quality conditions, 2) determine the severity and extent of any contamination, 3) evaluate temporal trends in water quality, and 4) identify any threats to groundwater quality and determine where further study or action is warranted to protect groundwater resources.

1.2 Purpose

This 2010 Groundwater Quality Report summarizes the results of groundwater quality monitoring conducted in Santa Clara County (County) during calendar year 2010. This includes results of the District's monitoring program data and other monitoring data acquired through the California Department of Public Health (CDPH) water quality database which contains data from water suppliers, including water retailers, mutual water systems and municipalities. The use of these two data sources provides an improved spatial distribution of sampling points (wells) for the evaluation of regional groundwater quality conditions and helps to minimize District sampling costs.

Using 2010 groundwater quality data collected by the District and water suppliers, this report will evaluate the following:

- General groundwater quality conditions based on major and minor ions, nutrients, trace elements, volatile organic compounds, pesticides, and radionuclides.
- Groundwater quality as compared to drinking water standards.
- Groundwater quality as compared to agricultural objectives.
- Water quality trends for select constituents (nitrate, total dissolved solids, and chloride) over the last ten years.

1.3 Report Organization

This report is organized into 5 sections including this introduction. Section 2 provides a brief description of the study area and summarizes the number and types of wells tested by both the District and water suppliers. Section 3 discusses results of monitoring organized according to water quality constituent groups. Trends in select constituents over the last decade are discussed in Section 4. Lastly, Section 5 provides a summary of the entire report. Within each section, the tables and figures are presented at the end of the section, unless otherwise noted.

2.0 Summary of 2010 Groundwater Quality Monitoring

2.1 Study Area and Generalized Hydrogeology

Santa Clara County harbors significant groundwater resources beneath its flat valley regions. This resource has been drawn upon since the late nineteenth century and currently provides about half of all water used in the County. Groundwater is pumped from layers of loose sand and gravel that have washed in from adjacent highlands by erosion, filling an alluvial basin under the wide, relatively flat valley floor. The valley floor is divided into three groundwater study areas – the Santa Clara Plain and Coyote Valley in the Santa Clara Subbasin, and the Llagas Subbasin. The Santa Clara Plain and Llagas Subbasin have laterally extensive low-permeability units, which form confining layers and separate the subbasins into confined portions and recharge areas as shown in Figures 2-1 and 2-2.

For the purposes of this report, the Santa Clara Plain and Llagas Subbasins are further divided into shallow and deep aquifer zones. The vast majority of water used within the County is pumped from the deeper aquifer zone, which will be referred to as the principal aquifer zone throughout this report. For the purposes of this analysis and report, wells with a total depth greater than 150 feet are assumed to represent the principal aquifer zone. It should be noted that the concept of shallow and principal aquifer zones is not strictly applicable in the recharge areas. However, the general categorization is still worthwhile in that it allows for the separate evaluation of water quality from very shallow zones and from the deeper zones that are more commonly drawn upon for beneficial use. Figures 2-3 and 2-4 illustrate the wells sampled by both the District and by water suppliers in 2010.

2.2 District Monitoring

The District collected groundwater quality samples from 70 wells in September and October 2010. The wells sampled represent a mix of dedicated monitoring wells and private domestic water supply wells. To evaluate regional groundwater quality conditions and assess changes in quality, the District analyzed samples for major and minor inorganic compounds, volatile organic compounds, and other commonly included parameters such as nitrate, total dissolved solids (TDS), and specific conductance (or electrical conductivity [EC]). See Appendix A for a complete list of parameters analyzed by the District. Samples were collected in accordance with widely accepted procedures for groundwater sample collection, filtering, preservation, and handling. The District provided a copy of the laboratory results for each well sampled by the District to the respective well owners.

2.3 Water Supplier Monitoring

Each year, the District acquires data from CDPH which includes the results of monitoring undertaken by the County's water retailers and other water suppliers for compliance with CDPH regulations. For 2010, the CDPH database has data on 233 wells within the County that were sampled and analyzed for a wide range of constituents. Only 224 of these wells were used in this evaluation because 9 wells are located outside the limit of the groundwater subbasins. In general, the CDPH wells used in this evaluation are high capacity production wells with multiple screens drawing water from numerous individual aquifer zones. In addition to those parameters analyzed under the District's program, the CDPH data contains information on radionuclides, and semi and non-volatile organics (pesticides), and some currently unregulated contaminants; including the herbicides dimethoate, metolachlor and alachlor as required by the Federal Unregulated Contaminant Monitoring Rule 2 (UCMR2) regulations. A complete listing of all parameters compiled into the 2010 dataset used for this report is presented in the tables in Appendix B.

A summary of the number of wells sampled in each subbasin by both the District and water suppliers is shown in Table 2-1. It should be noted that not every well is sampled for the same group of constituents. While wells in the District's groundwater quality monitoring network are sampled for a consistent set of parameters, listed in Appendix A, water quality data from the water supplier wells for CDPH compliance varies in terms of constituents analyzed. Also, CDPH monitoring frequency varies based on the status of the well and previous sampling results.

Table 2-1. Number of Wells Sampled for Each Study Area – 2010

Subbasin	**Wells Sampled by District**	**Wells Sampled by Water Suppliers**	**Totals**
Santa Clara Subbasin			
Santa Clara Plain - Shallow Aquifer Zone	13	1	14
Santa Clara Plain - Principal Aquifer Zone	7	159	166
Coyote Valley	9	15	24
Llagas Subbasin			
Shallow Aquifer Zone	21	0	21
Principal Aquifer Zone	20	49	69
Total	**70**	**224**	**294**

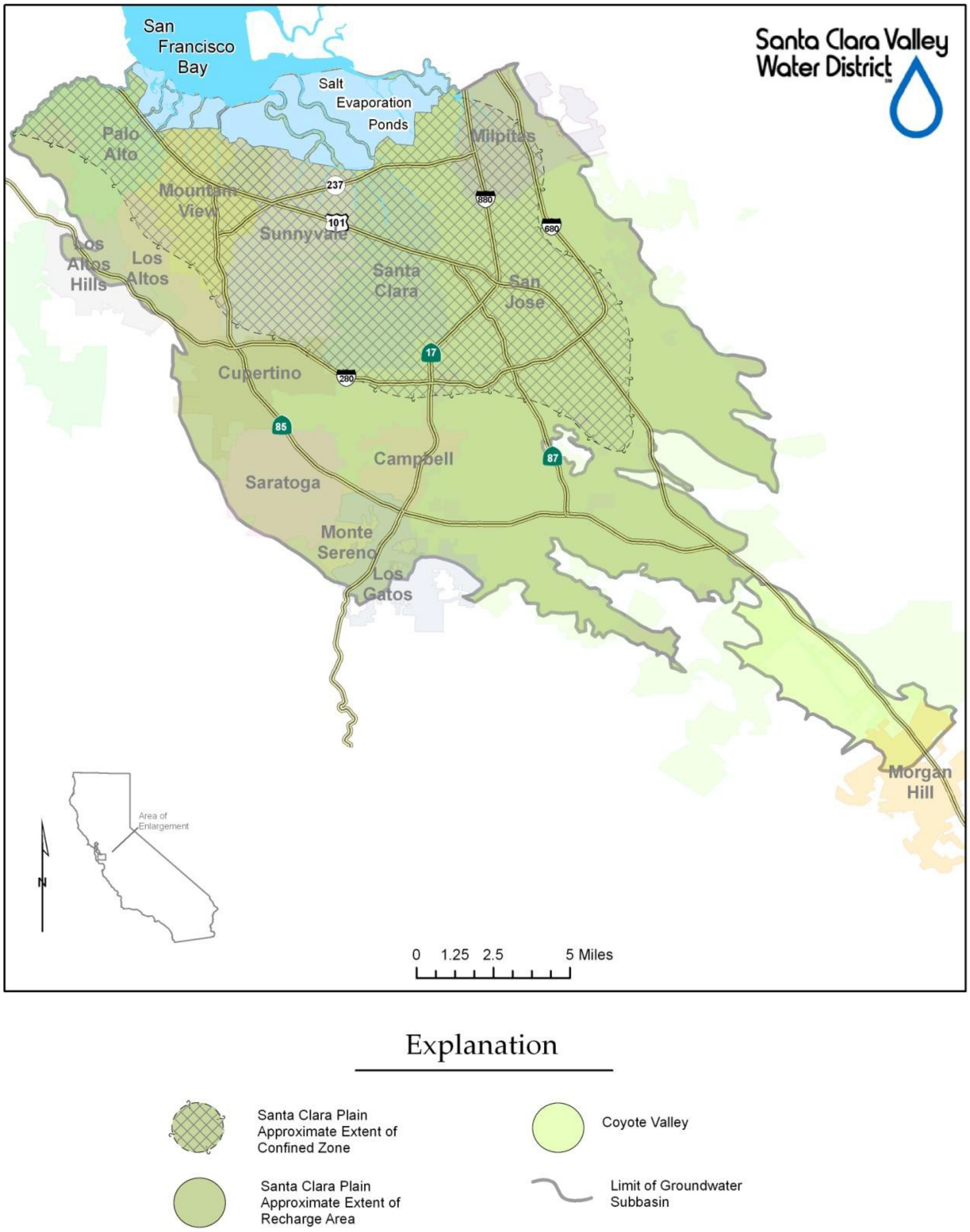

Figure 2-1, Extent of Recharge Area and Confined Zone of the Santa Clara Subbasin

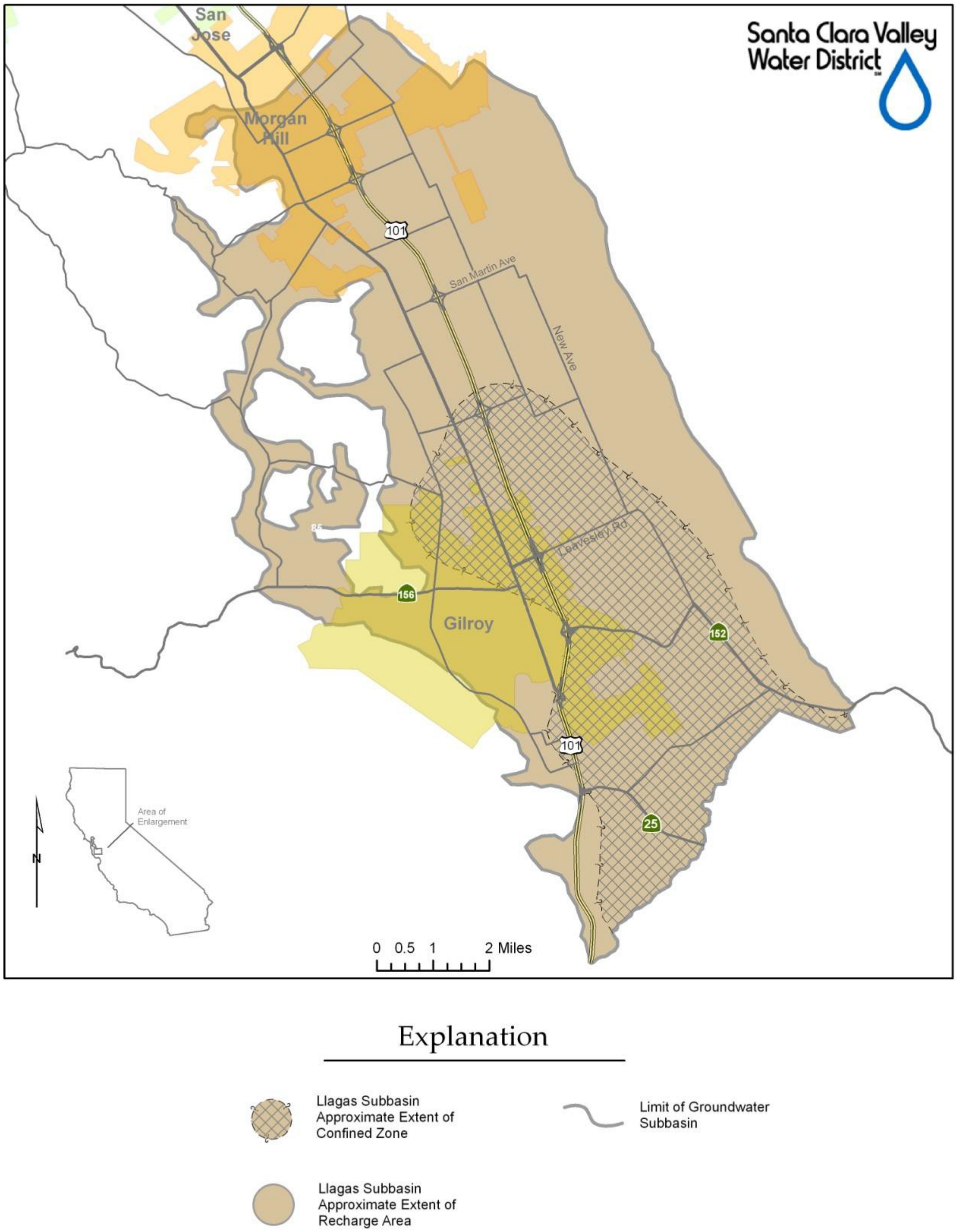
Santa Clara Valley Water District
San Jose
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
85
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.5 1 2 Miles
Explanation
Llagas Subbasin Approximate Extent of Confined Zone
Limit of Groundwater Subbasin
Llagas Subbasin Approximate Extent of Recharge Area

Figure 2-2, Extent of Recharge Area and Confined Zone of the Llagas Subbasin

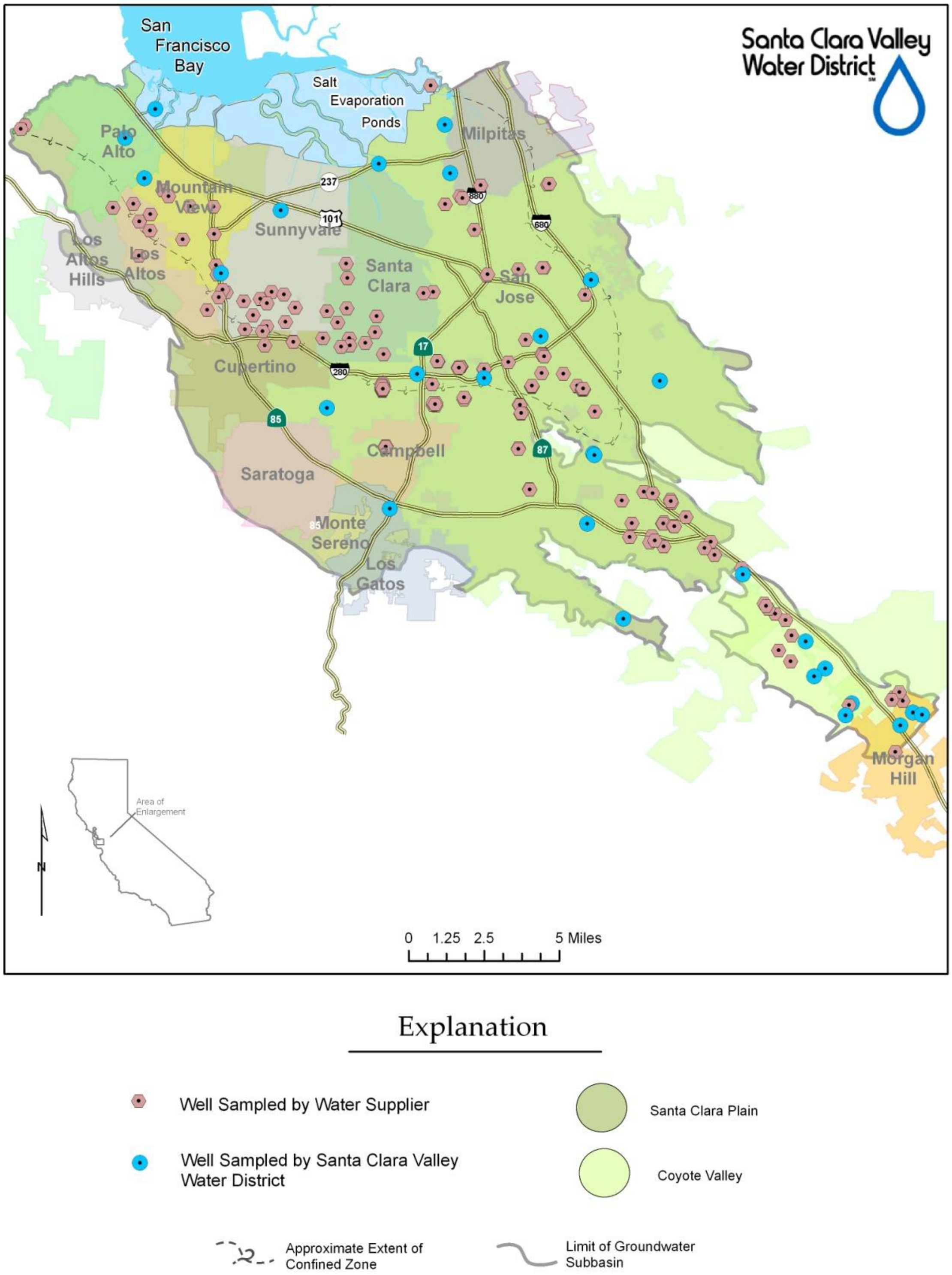

Figure 2-3. Location of Wells Sampled in 2010, Santa Clara Subbasin

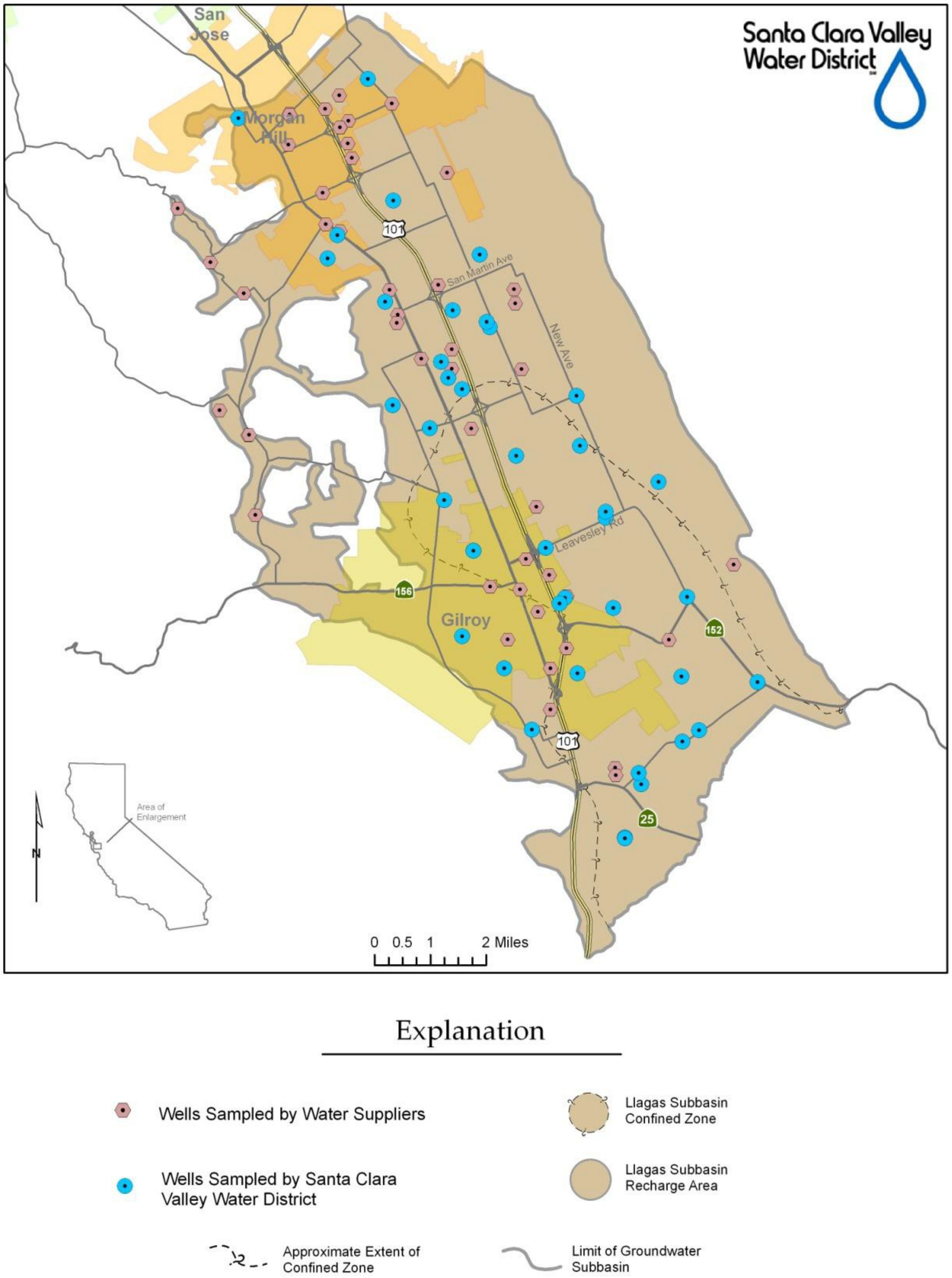
San Jose
Santa Clara Valley Water District
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.5 1 2 Miles
Explanation
Wells Sampled by Water Suppliers
Wells Sampled by Santa Clara Valley Water District
Llagas Subbasin Confined Zone
Llagas Subbasin Recharge Area
Approximate Extent of Confined Zone
Limit of Groundwater Subbasin

Figure 2-4. Location of Wells Sampled in 2010, Llagas Subbasin

3.0 Groundwater Quality – 2010 Status

Groundwater quality in Santa Clara County's three groundwater study areas was monitored in the fall of 2010 by the District and throughout the year by the various local water suppliers. Groundwater samples were analyzed for a large number of organic substances (volatile organic compounds [VOCs], semi-VOCs, pesticides, and pesticide degradation products), naturally occurring inorganic constituents (major ions, nutrients, and trace elements), radioactive constituents, and miscellaneous water quality indicators.

3.1 Interpretation of Groundwater Quality Results

The results of groundwater sample analyses are described briefly in the following sections. Unlike public water suppliers who sample for compliance purposes, the District samples groundwater to assess regional conditions. Concentrations in groundwater are compared to CDPH health-based and aesthetic thresholds as a way to provide context for the results presented in this report. Concentrations are also compared to thresholds for agricultural use established by the San Francisco Regional Water Quality Control Board (SFRWQCB) and the Central Coast Regional Water Quality Control Board (CCRWQCB).

It should be noted that the identification of any constituent above regulatory standards in this report does not necessarily indicate the delivery of unsafe water to consumers. Public water suppliers are required to meet drinking water standards, which may require blending or treatment prior to delivery. The following thresholds are used for comparison:

- **Maximum Contaminant Level (MCLs).** These are enforceable standards designed to protect public health by limiting the amount of contamination in drinking water that apply to public water systems. MCLs established by the US Environmental Protection Agency (USEPA) are the minimum standards to which states must adhere, although individual states may adopt more stringent standards. California has set stricter MCLs for certain contaminants. CDPH has also set MCLs for a few contaminants not regulated by USEPA. In this report, concentrations are compared to the more stringent standard. Although there are no MCLs for lead and copper, concentrations were compared to action levels, as defined in the CDPH Lead and Copper Rule.

- **Secondary Maximum Contaminant Level (SMCLs).** Secondary Maximum Contaminant Levels (SMCLs) address aesthetic issues related to taste, odor, or appearance of the water and are not related to health effects. In general, SMCLs established by CDPH are used in this report**.** For one constituent, pH, results are compared to the USEPA SMCL since CDPH does not have a threshold. Concentrations of sulfate, chloride, total dissolved solids, and specific conductance, are compared to both a “recommended” and an “upper” SMCL as identified by CDPH.

- **Basin Plan Agricultural Objectives.** The Regional Water Quality Control Boards have established thresholds for agricultural use (including irrigation, farming, etc) in Basin Plans. In this report, concentrations are compared to agricultural water quality objectives in the

Basin Plan for the San Francisco Bay Region (for the Santa Clara Subbasin, which includes the Santa Clara Plain and Coyote Valley) and the Central Coast Region (for the Llagas Subbasin).

All comparison thresholds used in this report are presented in Appendix B, Tables B-1 through B-6.

3.2 Water Quality Results

Groundwater samples collected in Santa Clara County were analyzed for approximately 217 chemical constituents; the District's sampling effort quantified 90 individual chemical constituents. All constituents are grouped into one of 4 broad chemical groups, or classes including water quality indicators, organic constituents, inorganic constituents, and radioactive constituents as presented in Table 3-1. This section of the report will discuss results of monitoring for each of the chemical classes separately.

Figures 3-1 and 3-2 illustrate the geographic locations of wells with constituents detected above drinking water standards in 2010.

In the following sections, detected water quality indicators and chemical constituents are identified and tabulated. Also presented is the number of wells with detections greater than health-based or aesthetic-based thresholds.

3.2.1 Water Quality Indicators

For this report, water quality indicators are defined as those physical and aggregate properties of water that are not specific to individual chemical compounds or elements, yet provide an indication of the overall quality of water. They are summarized in Table B-1 along with their regulatory comparison thresholds. None of the constituents in this group have established health-based thresholds, although many do have aesthetic-based thresholds.

Of the more important indicators, alkalinity is a measure of the waters ability to neutralize acid and plays an important role in the natural processes that affect water quality. Specific conductance is a measure of the waters ability to conduct an electrical current at a specific temperature (25°C) and directly correlates to the amount of dissolved mineral salts in water. The acidity and basicity of water is measured by pH, which, like alkalinity, controls various processes affecting water quality, most notably the ability of water to dissolve substances. There are no aesthetic-based thresholds for hardness; however, hardness is important aspect of quality both in the domestic and industrial setting. Hardness results from multivalent metal cations, notably calcium and magnesium. Hard water is not desirable as it can react with soap forming insoluble and unattractive residues on fixtures, in addition to limiting heat transfer in boilers.

Specific conductance was measured above the CDPH SMCL recommended value of 900 microSiemens per centimeter (µS/cm) in a total of 30 wells (17% of wells tested). One well had a specific conductance value greater than the CDPH upper SMCL 1,600 µS/cm. This well is a shallow aquifer zone monitoring well not used for domestic or municipal supply.

Turbidity was measured above the SMCL of 5 NTU in 1 well located in Coyote Valley. Color was also detected above the SMCL in this same well. No other water quality indicator parameters were detected above applicable thresholds. A summary of only those water quality indicators detected above comparison thresholds is presented in Table 3-2.

3.2.2 Organic Constituents

Volatile Organic Compounds (VOCs) and Semi VOCs

VOCs are used extensively in everyday life including in paints, solvents, motor fuel, fuel additives, fumigants, and refrigerants. A total of 78 individual VOCs were analyzed in 2010. Twelve other non-volatile or semi-volatile organic compounds have been grouped together with the VOCs for practical purposes (Table B-2). These include polycyclic aromatic hydrocarbons, plasticizer, explosives, and feedstock chemicals used for the manufacture of various other chemical compounds and products. For simplicity, all 90 chemical compounds in this constituent grouping are referred to as VOCs.

Of these 90 VOCs, 81 were not detected in any samples. Nine VOCs were detected above laboratory detection limits, although all detections were below MCLs and SMCLs. The most frequently detected VOCs are 1,1,1-trichloroethane, Freon 113, and chloroform. The number of wells with reported detections, the maximum concentration detected, and comparison thresholds for each of the 9 detected VOCs are shown in Table 3-3. Table B-3, located in Appendix B, summarizes VOC detections according to subbasin and aquifer zone.

Pesticides

Pesticides include herbicides, insecticides, and fungicides used to control weeds, insects, fungi and other pests in the agricultural, suburban, and urban environments. The 2010 analytical results for 60 pesticides and pesticide degradation products including laboratory reporting levels are summarized in Table B-4. No pesticides were detected above laboratory detection limits or MCLs or SMCLs. One constituent within this group has an established SMCL.

3.2.3 Inorganic Constituents

Most of the constituents in this class are derived in solution by means of natural processes including erosion and rock weathering, although their concentration in groundwater can be influenced by human activities. The constituents in this class are listed and summarized in Table B-5 and consist of common and relatively abundant constituents (major ions), less abundant ions (minor ions), nutrients, and certain elements which are present in solution, but only in minute quantities.

The major ion composition, total dissolved solids (TDS), and certain trace elements affect the aesthetic qualities of groundwater including taste, color, odor, and propensity of staining and scale formation. Other constituents in this class can adversely affect human health, and in the case of nitrate, particularly the health of infants. A total of 17 constituents in this class have established health-based MCLs and 9 have aesthetic-based SMCLs. For those detections above established thresholds, a summary table according to subbasin and aquifer zone is presented in Table 3-4. Table B-5, located in Appendix B, contains more detailed information on the concentration of inorganic constituents detected.

Aluminum, nitrate and perchlorate were detected above their respective MCLs, with nitrate detected most frequently. Aluminum was detected above the MCL in two wells in the Santa Clara Plain and one well in the Coyote Valley. One of 155 wells tested located in the Santa Clara Plain was found to contain nitrate in excess of the MCL (less than 1%) and concentrations in the study area ranged from non-detectable to 48 mg/L. In Coyote Valley, 2 of 22 wells (9%) tested contained nitrate above the MCL. Concentrations of nitrate ranged from non-detectable to a maximum of 52 mg/L. The Llagas Subbasin had the most detections of nitrate above the MCL with 9 of 66 (14%) wells having concentrations greater than the MCL of 45 mg/L. In the shallow aquifer zone of the Llagas Subbasin, about 50% of wells had nitrate above the MCL, with a maximum concentration of 199 mg/L measured in one well. Nitrate can interfere with the blood's ability to transport oxygen and is of greatest concern for infants and pregnant women. The effects of nitrate are often referred to as "blue baby syndrome."

Perchlorate was detected above the MCL in 2 wells in the Llagas Subbasin principal zone. Perchlorate can have adverse health effects when present above MCLs as it can interfere with iodine uptake in the thyroid gland, which can affect hormones that regulate metabolism and growth. A highway safety flare manufacturing facility operated in Morgan Hill from the 1950s to the mid-1990s. Due to onsite activities, perchlorate leached through the soil into groundwater over time, a condition that was first discovered in 2000 during investigation by a potential buyer. When the extent of contamination was defined, it became clear that hundreds of private wells and several municipal water wells were affected. At the urging of the District and the community, the Central Coast Regional Water Quality Board has taken timely action to ensure the contaminated groundwater is restored. Perchlorate levels have decreased significantly and the plume is getting smaller. As of March 2011, the responsible party is providing replacement water for 13 wells compared to 661 wells requiring replacement water in 2004. Groundwater remediation activities by the responsible party are ongoing.

Aluminum, chloride, iron, manganese, and TDS, were all detected above their respective SMCLs in several wells. There were 21 samples for hexavalent chromium (chromium-6) collected in the principal zone of the Santa Clara Plain by a water supplier. Concentrations ranged from 0.27 to 2.5 µg/L. No samples were analyzed for chromium-6 in either the Coyote Valley or Llagas Subbasin. While total chromium has a drinking water standard (with no exceedances noted in 2010), chromium-6 is not yet specifically regulated. The district will continue to be actively engaged in the state and federal process to establish a science-based drinking water standard for chromium-6 that is protective of public health.

For the reasons explained in the following sections, two constituents of particular interest are chloride and nitrate. These sections provide more detailed information on the occurrence of these constituents and provide a more detailed summary of the data analyzed.

Chloride and Saltwater Intrusion

Saltwater intrusion of the Santa Clara Plain shallow aquifer zone adjacent to the southern shore of the San Francisco Bay has been studied and monitored for many years by the District. Although the intrusion has been somewhat widespread in the shallow aquifer zone, on the basis of historic data, it does not appear that the lower aquifer has been affected significantly.

The current monitoring effort of the shallow aquifer zone in the affected area consists of a focused monitoring network and an evenly spaced grid network of wells as shown in Figure 3-3. The grid network is sampled annually for general water quality constituents. Every third year, the focused monitoring network is also sampled to better constrain and understand the extent and severity of saltwater intrusion. Since the focused network was not monitored this year, no attempt to delineate the extent of intrusion was made during this monitoring period. However, many of the wells in the affected are showing a long-term downward trend in chloride content, suggesting that conditions are improving somewhat. Trends are discussed in Section 4.

Nitrogen

Nitrogen is a particularly important constituent within the inorganic constituent group. It is present in a number of wells, in the form of nitrate, at concentrations above the MCL. Nitrogen compounds are part of a complex cycle involving the production and breakdown of nitrogen (N_2) gas, nitrite, nitrate, and ammonia. Soil bacteria play an important role in converting atmospheric nitrogen into a form usable by plants. When the plants die, ammonia is produced as a result of their decay. This ammonia is used by soil bacteria to produce nitrite, which in turn is then transformed to nitrate by another group of bacteria. In a natural setting, a delicate balance is maintained such that no excess nitrate is available to be leached beyond the root zone.

Agricultural practices encourage plant growth through the addition of commercial fertilizers containing nitrogen compounds, usually in the form of nitrate. If fertilizer is applied in excess of plant needs, the excess can be leached to groundwater. Other sources of nitrogen compounds which can be leached to groundwater include animal waste, septic systems, and wastewater discharges. In 2010, all occurrences of nitrate above the MCL, except for one, occurred in the Coyote Valley and Llagas Subbasin. Nitrate results are summarized by study area/subbasin and aquifer zone in Table B-5.

As elevated nitrate concentrations have been an ongoing groundwater quality challenge, the District has undertaken numerous efforts to define the extent and severity of nitrate contamination, identify potential sources, reduce nitrate loading, and reduce customer exposure to nitrate. These efforts have included establishing a nitrate monitoring network, performing free nitrate sampling for nearly 600 wells since 1998, implementing on-site nutrient assistance programs to growers between 2002 and 2007, and conducting various outreach activities regarding nitrate. Current efforts focus on the evaluation of nitrate data to assess hot spots and trends, public outreach, and collaboration with other agencies to increase water and nutrient use efficiency. Nitrate management strategies will also be evaluated as part of the regional salt and nutrient management plans, which are scheduled to be developed by 2014 in coordination with groundwater basin stakeholders.

3.2.4 Radioactive Constituents

Radioactivity is the release of energy or energetic particles resulting from the rearrangement of the structure of the nucleus of certain atoms. The decay of the isotopes of uranium and thorium present in natural deposits results in most of the radioactivity in groundwater. Each step in the decay series results in the release of alpha or beta particles, or radiation. Radium-226 and Radium-228 are radioactive isotopes formed during the uranium-thorium decay series. These isotopes and emitted particles are hazardous to human health as they can damage cell structure. Radioactivity is commonly measured in units of “activity” rather than concentration. The unit of activity is picocuries per liter (pCi/L) and is roughly equivalent to two atoms decaying per minute. For certain types of ionizing radiation, the traditional unit of measurement is the radiation dose equivalent called roentgen equivalent in mammals, or rems per year.

Activity of gross alpha radiation was below the health-based threshold in all wells tested for this constituent in all subbasins. Activity counts ranged from a low of <3 pCi/L to a high of 7.08 pCi/L. The median count of alpha radiation is reported as <3 pCi/L. Gross beta, radium-226, and radium-228 activities were below their respective MCLs in all wells tested for these constituents. The constituents in this group are listed and summarized in Table B-6 along with comparison thresholds.

3.3 Agricultural Water Quality

In addition to comparing concentrations of constituents to drinking water standards, concentrations of select constituents in groundwater are also compared to standards for agricultural use (irrigation, farming, etc) established by the Regional Water Quality Control Boards. Agricultural threshold values are found in Table 3-6 of the SFRWQCB Basin Plan and Tables 3-3 and 3-4 of the CCRWQCB Basin Plan, updated December 31, 2010, and August 5, 2006, respectively.

The Santa Clara Subbasin, which includes the Santa Clara Plain and Coyote Valley, is under the jurisdiction of the SFWQCB and the Llagas Subbasin is under the jurisdiction of the CCRWQCB. Since each region has slightly different threshold values, they will be discussed separately. The constituents with agricultural objectives and comparison thresholds for the San Francisco Bay and Central Coast regions are listed in Table 3-5.

San Francisco Bay Region (Santa Clara Subbasin)

In general, groundwater quality throughout the San Francisco Bay region meets the agricultural objectives set by the Regional Board with a few exceptions. The constituents detected above agricultural objectives are boron, chloride, iron, manganese, nitrate, nitrate + nitrite as N, specific conductance, and adjusted Sodium Adsorption Ratio (SAR). It should be noted that, although there are few results for nitrate + nitrite, the associated threshold is considered to be exceeded if the nitrate concentration alone exceeds the threshold value. Most of the impacts above agricultural objectives in the principal aquifer zone are due to nitrate. Manganese, boron, chloride, iron, and SAR were rarely detected above agricultural objectives. Figure 3-4 depicts the location of wells with detections of agricultural objectives in the Santa Clara Subbasin.

Central Coast Region (Llagas Subbasin)

In general, groundwater quality throughout the Llagas Subbasin meets the agricultural objectives set by the Regional Board with a few exceptions. Five constituents are detected above agricultural objectives including bicarbonate, chloride, specific conductance, nitrate, and SAR.

According to Table 3-3 of the Central Coast Basin Plan, the objective for specific conductance of 750 µS/cm is at the lower end of the range for increasing problems due to salinity and severe problems do not develop until 3,000 µS/cm is reached. Ten wells in the shallow aquifer zone and 10 wells in the principal aquifer zone were found to have specific conductance values greater than the lowest limit of 750 µS/cm. However, all the wells had concentrations far below the level in which severe problems would be expected to occur, with maximum values of 1280 µS/cm and 1100 µS/cm in the shallow and principal aquifer zones, respectively.

Specific conductance is also used to assess the potential of irrigation water to alter the drainage characteristics of soil, or soil permeability. Unlike other constituents, in which a maximum value is established, soil permeability is protected by establishing a minimum value of specific conductance of 500 µS/cm. Severe problems are expected to occur when irrigation water has a specific conductance of less than 200 µS/cm. In the Llagas Subbasin, four wells in the shallow aquifer zone and six wells in the principal aquifer zone had specific conductance values less than 500 µS/cm. However, no wells in either zone had specific conductance values less than 200 µS/cm, which would indicate severe problems.

Bicarbonate was measured above the lowest objective of 90 mg/L in all wells tested. However, no wells had bicarbonate above the level at which severe problems would be expected to arise (520 mg/L). Irrigation water high in bicarbonate can cause deposits of calcium carbonate to appear on leaves of plants if overhead sprinklers are used.

Detections of chloride and SAR above established objectives were rare, with only one well affected by chloride and 2 wells affected by adjusted SAR.

District staff will continue to monitor potential water quality changes that may impact agricultural use. A summary of wells having concentrations of constituents greater than established agricultural objectives is presented in Table 3-6. The location of wells with detections above agricultural objectives in the Santa Clara Subbasin and Llagas Subbasin is depicted graphically on Figures 3-4 and 3-5, respectively.

Table 3-1. Classes of Constituents Sampled in Calendar Year 2010

Constituent Class	Constituent list table
Water Quality Indicators	
Alkalinity	B-1
Color	B-1
Foaming agents (MBAS)	B-1
Hardness as $CaCO_3$	B-1
Odor threshold @ 60C	B-1
pH	B-1
Specific Conductance	B-1
Turbidity	B-1
Temperature	B-1
Organic Constituents	
Volatile organic compounds	B-2 & B-3
Pesticides and pesticide degradation products	B-4
Inorganic Constituents	
Major and minor ions	B-5
Trace elements	B-5
Nutrients	B-5
Radioactive Constituents	
Gross alpha radiation	B-6
Gross beta radiation	B-6
Radium 226	B-6
Radium 228	B-6
Uranium	B-6

Table 3-2. Summary of Water Quality Indicators Detected above Drinking Water Thresholds - 2010

Constituent	Number of wells analyzed	Number of wells above threshold[1]	MCL[2]	SMCL[3]
Santa Clara Subbasin Santa Clara Plain – Shallow Aquifer Zone				
Specific Conductance (µS/cm)	14	6 (1)	--	900 (1,600)
Santa Clara Subbasin Santa Clara Plain – Principal Aquifer Zone				
Specific Conductance (µS/cm)	72	14 (0)	--	900 (1,600)
Santa Clara Subbasin Coyote Valley				
Specific Conductance (µS/cm)	17	1 (0)	--	900 (1,600)
Turbidity (NTU)	8	1	--	5
Color (Color Units)	8	1	--	15
Llagas Subbasin – Shallow Aquifer Zone				
Specific Conductance (µS/cm)	21	6 (0)	--	900 (1600)
Llagas Subbasin – Principal Aquifer Zone				
Specific Conductance (µS/cm)	50	3 (0)	--	900 (1,600)

Notes: µS/cm = microSiemens per centimeter; NTU = Nephelometric Turbidity Units
Shallow Zone = wells with total depth less than 150 feet. Principal Zone = wells with total depth greater than 150 feet.

1. The number of wells with detections above the recommended threshold is listed, with the number of wells with detections above the upper threshold shown in parentheses.
2. MCL = Maximum Contaminant Level, or health-based standard, set by the California Department of Public Health (CDPH).
3. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, set by the CDPH. For SMCLs having a range, the lower, recommended threshold is listed, with the upper threshold shown in parentheses.

Table 3-3. Number of Wells with Reported Detections of VOCs in 2010

Constituent	Number of wells with detection	Number of wells analyzed	Maximum concentration detected (μg/L)	MCL[1] (μg/L)
1,1,1-Trichloroethane	13	197	4.3	200
1,1,2-Trichloro-1,2,2-Trifluoroethane (FREON 113)	6	197	18	1,200
1-1-Dichlorethene	3	197	5.7	6
Bromoform (THM)	1	119	3.6	--[2]
Bromomethane (THM)	1	111	0.63	--[2]
Chloroform (THM)	3	119	17.8	--[2]
Di(2-ethylhexyl)phthalate	1	54	3.2	4
Tetrachloroethene	3	196	1	5

Notes: μg/L = micrograms per liter, equivalent to 1 part per billion

1. MCL = Maximum Contaminant Level, or health-based standard, set by the California Department of Public Health (CDPH).

2. No individual MCLs established; Total Trihalomethanes not to exceed 80 μg/L.

Table 3-4. Summary of Inorganic Constituents Detected above Drinking Water Thresholds - 2010

Constituent	Number of wells analyzed	Number of wells above MCL[1]	Number of wells above SMCL[2]	MCL	SMCL[3]
Santa Clara Subbasin Santa Clara Plain – Shallow Aquifer Zone					
Chloride (mg/L)	14	--	1 (1)	--	250 (500)
Iron (μg/L)	14	--	3	--	300
Total dissolved solids (mg/L)	14	--	6 (1)	--	500 (1,000)
Santa Clara Subbasin Santa Clara Plain – Principal Aquifer Zone					
Aluminum (μg/L)	73	2	2	1,000	200
Iron (μg/L)	71	--	14	--	300
Manganese (μg/L)	61	--	6	--	50
Nitrate (mg/L)	155	1	--	45	--
Total Dissolved Solids (mg/L)	64	--	10 (0)	--	500 (1,000)
Santa Clara Subbasin Coyote Valley					
Aluminum (μg/L)	17	1	1	1,000	200
Iron (μg/L)	17	--	1	--	300
Manganese (μg/L)	8	--	1	--	50
Nitrate (mg/L)	22	2	--	45	--
Total Dissolved Solids (mg/L)	17	--	1 (0)	--	500 (1,000)
Llagas Subbasin – Shallow Aquifer Zone					
Nitrate (mg/L)	21	10	--	45	--
Total Dissolved Solids (mg/L)	21	--	8 (0)	--	500 (1000)
Llagas Subbasin – Principal Aquifer Zone					
Manganese (μg/L)	13	--	1	--	50
Nitrate (mg/L)	66	9	--	45	--
Nitrate + Nitrite as N (μg/L)	15	1	--	10	--
Perchlorate (μg/L)	49	2	--	6	--
Total dissolved solids (mg/L)	33	--	3 (0)	--	500 (1,000)

Notes: μg/L = micrograms per liter; mg/L = milligrams per liter

Shallow Zone = wells with total depth less than 150 feet. Principal Zone = wells with total depth greater than 150 feet.

1. The number of wells with detections above the primary, health-based Maximum Contaminant Level (MCL) established by the CDPH.
2. The number of wells with detections above the CDPH recommended Secondary Maximum Contaminant Level (SMCL), or aesthetic-based standard. The number of wells with detections above the upper threshold shown in parentheses.
3. For constituents with a SMCL range, the lower recommended limit is listed, with the upper limit shown in parentheses.

Table 3-5. Agricultural Related Constituents and Basin Plan Objectives

Constituent	Units	San Francisco Bay Region[1]	Central Coast Region[2]
Aluminum	μg/l	5,000	5,000
Ammonium	mg/l	--	5
Arsenic	μg/l	100	100
Bicarbonate[3]	mg/l	--	90
Beryllium	μg/l	100	100
Boron	μg/l	500	500
Cadmium	μg/l	10	10
Chloride	mg/l	142	106[4]
Chromium	μg/l	100	100
Cobalt	μg/l	50	50
Copper	μg/l	200	200
Specific Conductance (Salinity)	μS/cm	200 – 3,000[5]	750[6]
Specific Conductance (Permeability)	μS/cm	--	<500[7]
Fluoride	μg/l	1,000	1,000
Iron	μg/l	5,000	5,000
Lead	μg/l	5,000	5,000
Lithium	μg/l	--	2,500
Manganese	μg/l	200	200
Molybdenum	μg/l	10	10
Nickel	μg/l	200	200
Nitrate + Nitrite as N[8]	mg/l	5	--
Nitrate as N	mg/l	--	5
Selenium	μg/l	--	20
Sodium Adsorption Ratio (adj.)	––	3	3
Vanadium	μg/L	100	100
Zinc	μg/l	2,000	2,000
pH	––	5.5 – 8.3	6.5 – 8.4

Notes:

1. Agricultural objectives shown are threshold values from the San Francisco Regional Water Quality Control Board Basin Plan (Table 3-6), except as noted.
2. Agricultural objectives shown are based on the maximum concentration for irrigation supply per Central Coast Regional Water Quality Control Board Basin Plan Table 3-4 (Water Quality Objectives for Agricultural Water Use) and Table 3-3 (Guidelines for Interpretation of Quality of Water for Irrigation), except as noted. If a constituent is listed in both tables, the lowest threshold is used.
3. The bicarbonate objective applies only to irrigation with overhead sprinklers.
4. The chloride objective represents the low end of the range for “increasing problems” for toxicity from foliar adsorption from Central Coast Basin Plan Table 3-3.
5. This represents the ideal range for irrigation water to be protective of both salinity and permeability hazards.
6. The specific conductance concentration represents the low end of the range for “increasing problems” for salinity from Central Coast Basin Plan Table 3-3.
7. To avoid damage to soil structure (permeability), specific conductance of irrigation water should not be less than 500 μS/cm.
8. The limit of 5 mg/L as N is equivalent to 22.5 mg/L Nitrate as NO_3 if nitrite is not present.

Table 3-6. Summary of Constituents Detected above Agricultural Objectives

Constituent	Number of wells analyzed	Number of wells greater than objective
Santa Clara Subbasin Santa Clara Plain – Shallow Aquifer Zone		
Boron	13	1
Chloride	14	1
Nitrate[1]	14	1[2]
Specific Conductance	14	1
SAR (adjusted)	14	3
Santa Clara Subbasin Santa Clara Plain – Principal Aquifer Zone		
Manganese	61	1
Nitrate[1]	155	36[2]
Nitrate + Nitrite as N	62	9
SAR (adjusted)	64	3
Santa Clara Subbasin Coyote Valley		
Chloride	17	1
Iron	17	1
Nitrate[1]	22	8[2]
Nitrate + Nitrite as N	8	1
SAR (adjusted)	17	1
Llagas Subbasin– Shallow Aquifer Zone		
Bicarbonate	21	21
Chloride	21	1
Nitrate	21	16
Specific Conductance (Salinity)	21	10
Specific Conductance (Permeability)	21	4
Llagas Subbasin – Principal Aquifer Zone		
Bicarbonate	33	33
Chloride	33	1
Nitrate	66	38
Specific Conductance (Salinity)	50	10
Specific Conductance (Permeability)	50	6
SAR (adjusted)	33	2

Notes:

1. No Individual agricultural objective is established for nitrate alone, however standalone nitrate analysis can be compared against the limit established for Nitrate + Nitrite as N. Any well with a nitrate concentration greater than 22.5 mg/l as NO_3 (approximately equal to 5 mg/l as N) can be assumed to exceed the limit set for “Nitrate + Nitrite as N.”

2. Number of wells exceeding limit set for Nitrate + Nitrite as N due only to nitrate. The limit of 5 mg/L as N (the agricultural objective for Nitrate + Nitrate as N) is equivalent to 22.5 mg/L Nitrate as NO_3

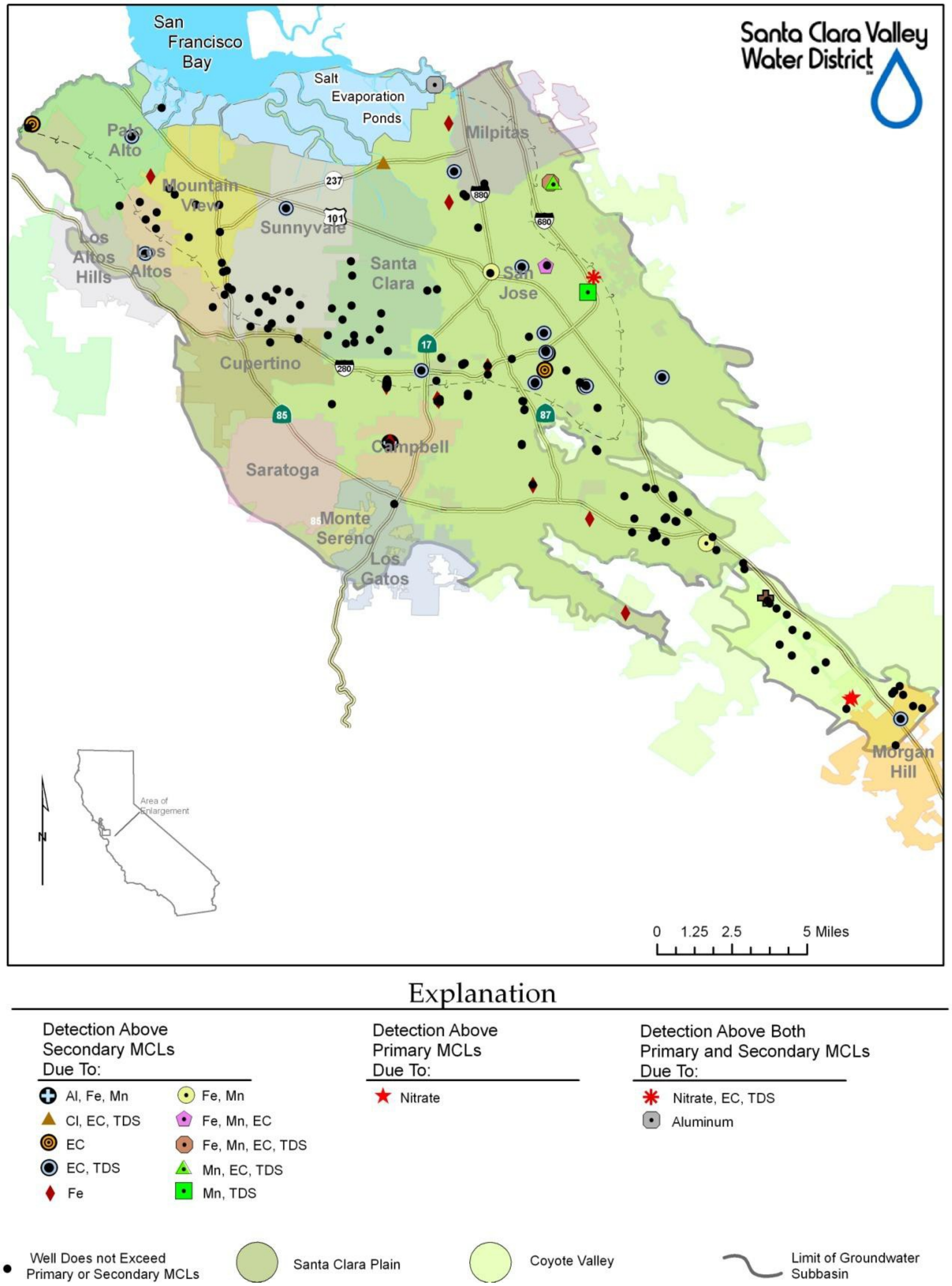

Figure 3-1. Wells with Constituents Detected Above Drinking Water Standards in 2010, Santa Clara Subbasin

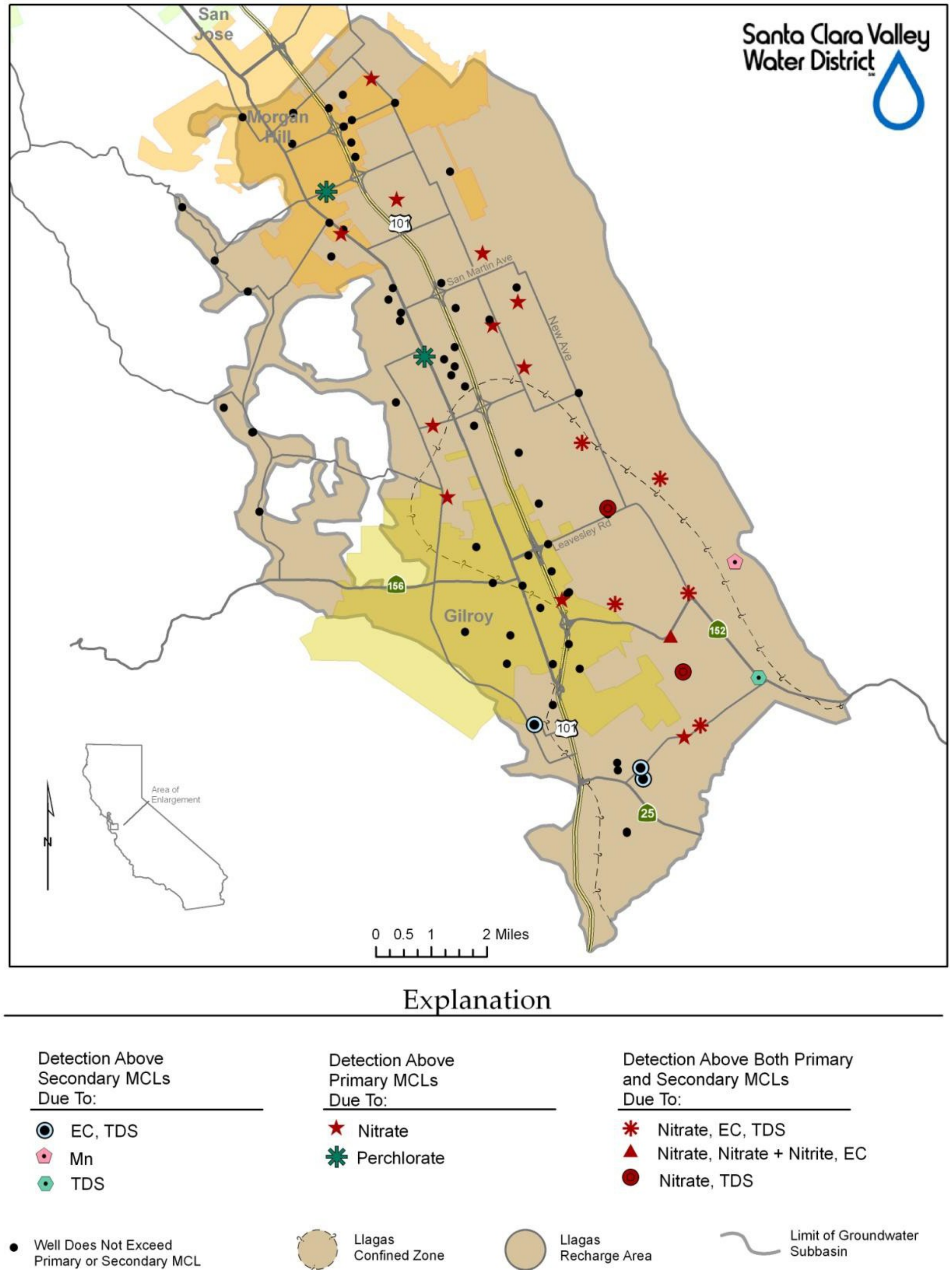
San Jose
Santa Clara Valley Water District
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.5 1 2 Miles
Explanation
Detection Above Secondary MCLs Due To:
◉ EC, TDS
⬟ Mn
⬢ TDS
Detection Above Primary MCLs Due To:
★ Nitrate
✳ Perchlorate
Detection Above Both Primary and Secondary MCLs Due To:
✳ Nitrate, EC, TDS
▲ Nitrate, Nitrate + Nitrite, EC
● Nitrate, TDS
● Well Does Not Exceed Primary or Secondary MCL
Llagas Confined Zone
Llagas Recharge Area
Limit of Groundwater Subbasin

Figure 3-2. Wells with Constituents Detected Above Drinking Water Standards in 2010, Llagas Subbasin

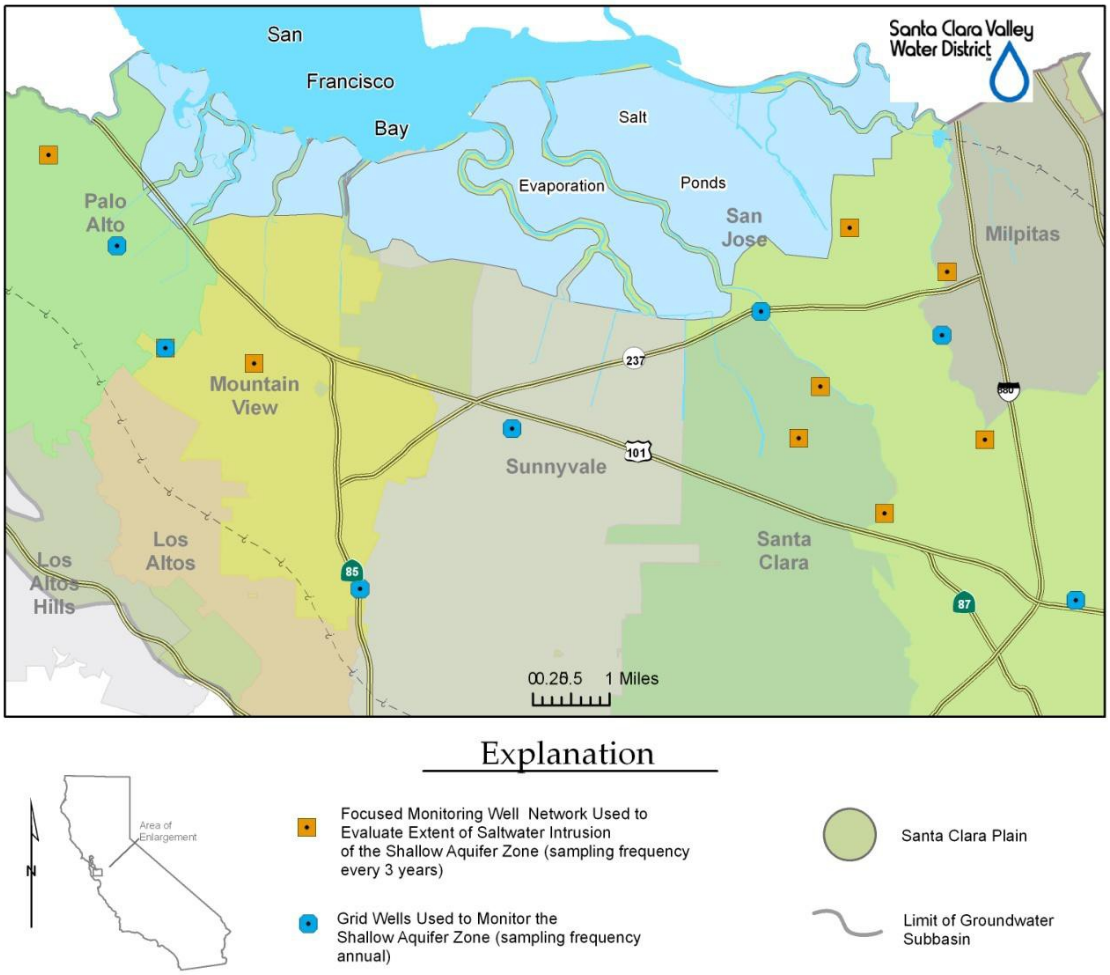
San Francisco Bay
Santa Clara Valley Water District
Salt Evaporation Ponds
Palo Alto
San Jose
Milpitas
Mountain View
Sunnyvale
Santa Clara
Los Altos
Los Altos Hills
237
880
101
85
87
0 0.25 0.5 1 Miles
Explanation
N
Area of Enlargement
Focused Monitoring Well Network Used to Evaluate Extent of Saltwater Intrusion of the Shallow Aquifer Zone (sampling frequency every 3 years)
Grid Wells Used to Monitor the Shallow Aquifer Zone (sampling frequency annual)
Santa Clara Plain
Limit of Groundwater Subbasin

Figure 3-3. Wells used to evaluate extent of saltwater intrusion of the shallow aquifer zone of Santa Clara Plain study area.

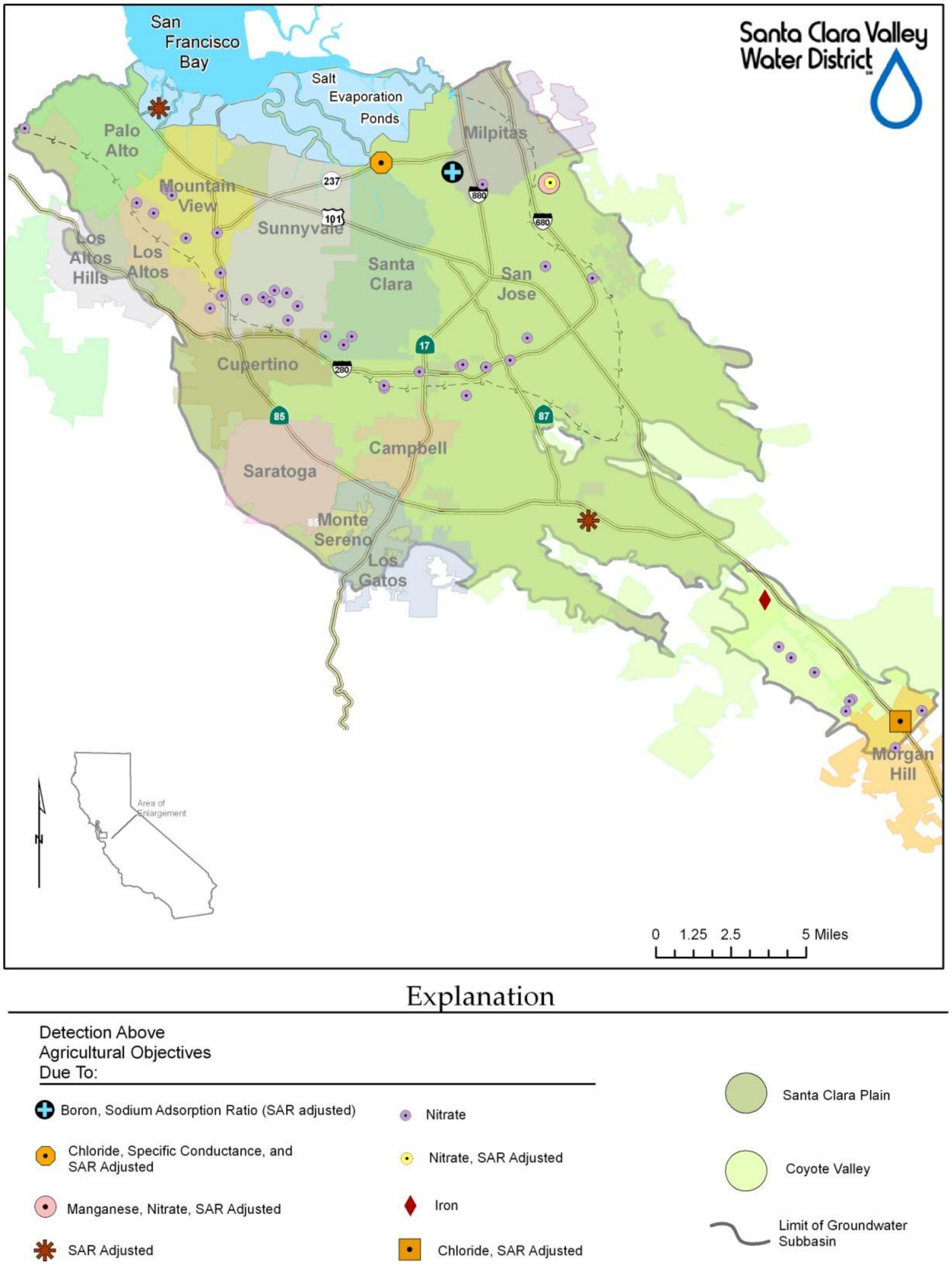

Figure 3-4. Location of wells with detections above agricultural objectives, Santa Clara Subbasin

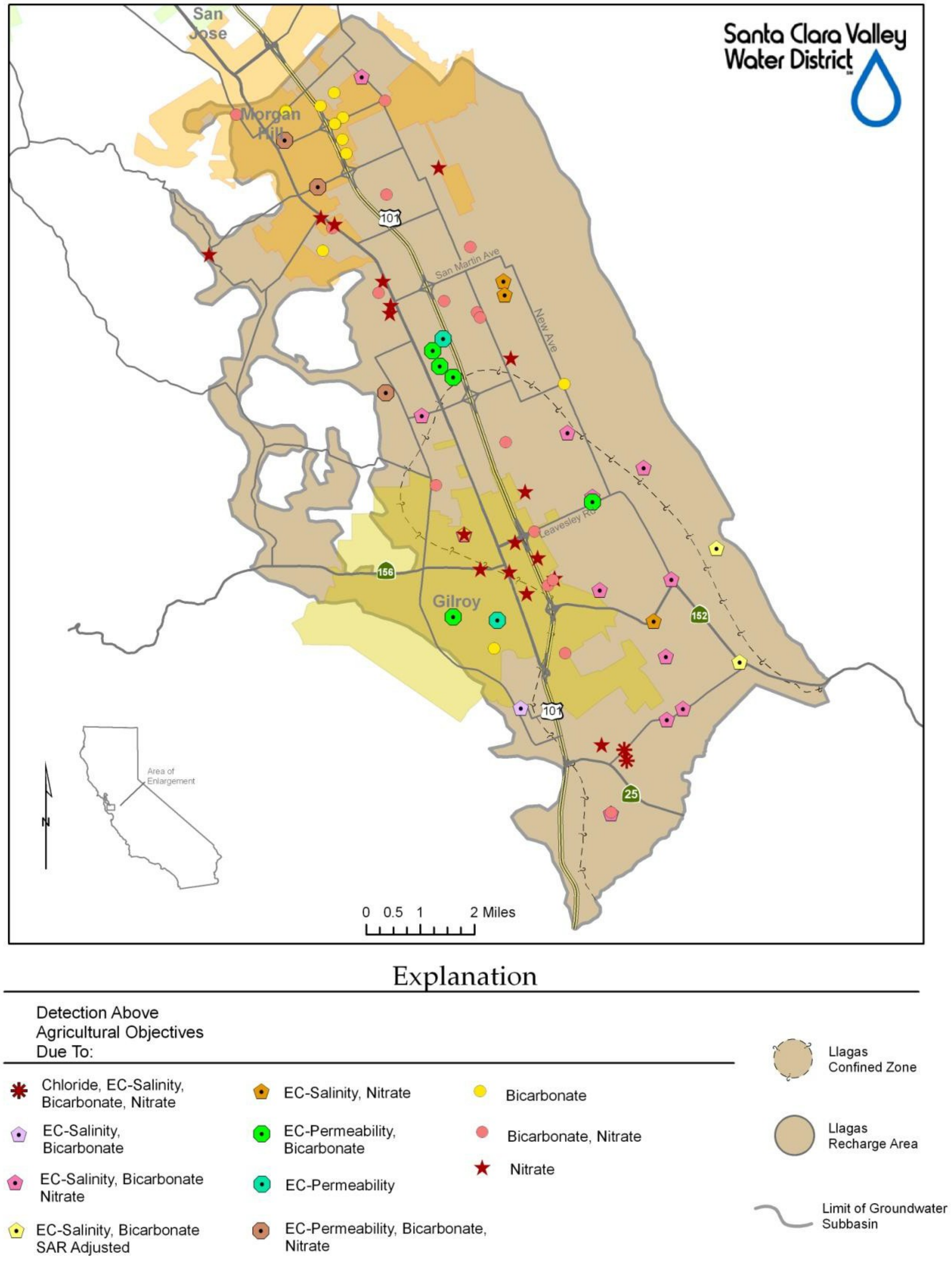
San Jose
Santa Clara Valley Water District
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.5 1 2 Miles
Explanation
Detection Above Agricultural Objectives Due To:
Chloride, EC-Salinity, Bicarbonate, Nitrate
EC-Salinity, Bicarbonate
EC-Salinity, Bicarbonate Nitrate
EC-Salinity, Bicarbonate SAR Adjusted
EC-Salinity, Nitrate
EC-Permeability, Bicarbonate
EC-Permeability
EC-Permeability, Bicarbonate, Nitrate
Bicarbonate
Bicarbonate, Nitrate
Nitrate
Llagas Confined Zone
Llagas Recharge Area
Limit of Groundwater Subbasin

Figure 3–5, Location of wells with detections above agricultural objectives, Llagas Subbasin

4.0 Evaluation of Trends for Nitrate, Chloride, and Total Dissolved Solids

The timely identification of adverse trends is an important goal of the District's monitoring program so that appropriate action can be taken to protect groundwater resources. The three constituents analyzed for trend are nitrate (as NO_3), chloride, and total dissolved solids (TDS). Nitrate was chosen for trend testing because it affects the largest number of wells in the County, chloride because of historical saltwater intrusion, and TDS because it is an indicator of salt loading and of overall water quality.

For this trend evaluation, a trend period of 10 years was chosen, beginning January 2001 and ending December 2010. Trend wells include approximately 100 wells monitored by the District and 213 wells sampled by water suppliers. The results of trend testing for wells representing each subbasin and aquifer zone for each constituent are summarized in Table 4-1. The number of wells analyzed for trend for each constituent and each zone varies, and was based on the availability of results for each constituent. Well sites having fewer than four records of data for each selected constituent were not included in this evaluation. The following section briefly describes the procedure used to evaluate trends.

4.1 Estimating Trends in Water Quality

To evaluate potential trends over time at individual wells sites, the simple (non-seasonal) Mann-Kendall test procedure was used. For wells with censored observations (data reported as "non-detectable"), the data was adjusted by re-censoring to the highest detection limit. This occurred for some nitrate wells and one chloride well.

For sites having a statistically significant trend, the magnitude of the trend is also estimated. The magnitude is the trend slope or rate at which concentration is increasing or decreasing over time for a given well. For sites having significant downward and upward trends, results of the trend analysis along with the magnitude of trend are presented in Appendix C and D, respectively. The well sites with no detectable trend are presented in Appendix E. A more detailed description of the trend analysis procedure and limitations is presented in Appendix F.

4.2 Trend Test Results

The Mann-Kendall test was used to test for trends in chloride, TDS, and nitrate in 201, 193, and 402 wells, respectively, across the three study areas as shown in Figures 4-1 through 4-6. For all constituents and aquifer zones, the majority of wells do not indicate clear evidence of trend. In the Santa Clara Plain and Coyote Valley, the location of wells with detectable nitrate and chloride trends did not appear to be entirely random with certain areas marked by wells having generally consistent trend results. The District will evaluate potential causes for these apparent clusters, some of which are positive (decreasing trends) and others that may indicate a localized concern (increasing trends). In the Llagas Subbasin, no easily discernable pattern of nitrate trend results was evident while trends of TDS and chloride were too few in number to attempt to discern any pattern.

A summary of the Mann-Kendall test results for each study area is presented in Table 4-1. Individual well sites having significant downward and upward trends are presented in Appendix C and D, respectively, along with the detailed results of the trend testing procedure.

4.2.1 Trends for Nitrate (as NO3)

The primary sources of nitrate in Santa Clara County include synthetic fertilizers, septic systems, and animal waste. The area overlying the Santa Clara Plain consists mostly of urban and suburban development. Almost all areas are served by municipal wastewater systems, thus the use of individual septic systems is rare. While once prevalent, only a few pockets of agricultural land remain today. Land use over the Coyote Valley is mixed; the northern portion is predominantly agricultural and the southern portion contains both agricultural use and suburban style residential development. No municipal wastewater collection system exists in much of Coyote Valley, therefore septic systems are common.

Land use over the Llagas Subbasin is mostly mixed agricultural and rural residential development, with two main incorporated areas consisting of the cities of Morgan Hill and Gilroy. While the incorporated areas are served by municipal wastewater systems, the unincorporated areas rely on individual septic systems for sanitary waste disposal. Furthermore, the southern portion of the Llagas Subbasin has significant agricultural production. Past land use also included a number of confined animal enclosures. Thus, most known sources of nitrate are, or have been present, in the Llagas Subbasin.

Santa Clara Subbasin

Santa Clara Plain

Sixteen wells representing the shallow aquifer zone of the Santa Clara Plain study area were analyzed for groundwater nitrate trend. The majority of wells tested did not show any trend (94%). One well was determined to have an upward trend and no wells were found to have statistically significant downward trend. The magnitude of trend for the one well having an upward trend was estimated at 0.8 mg/L/year.

Similar to the shallow zone, no nitrate trends were detected at the majority of wells analyzed from the principal aquifer zone of the Santa Clara Plain (85%). 34 of 231 wells (15%) showed evidence of trend; 15 wells had an upward trend and 19 wells had a downward trend. The magnitude of trend, or rate of increase, was estimated for the 15 wells with upward trends and ranged from 0.1 to 1.8 mg/L/year. The mean estimated rate of decrease for the 19 wells with downward trend is 0.8 mg/L/year.

While there were an approximately equal number of wells with increasing and decreasing trends, the distribution of these wells does not appear to be entirely random. An examination of the spatial location of trends results (Figure 4-1) reveals a few areas with distinct trend pattern. The area north of Metcalf Road, located in the southern portions of the Santa Clara Subbasin, is marked by downward trends in groundwater nitrate concentrations, although the rate of reduction is quite small. The downtown area of San Jose is marked by mostly increasing trends, while the Los Altos/Mountain View/Sunnyvale areas contains a mix with some wells having increasing trends and some decreasing.

Coyote Valley

The majority of wells in Coyote Valley did not indicate any trend for nitrate (64%). Statistically significant groundwater nitrate trends were identified at 10 of 28 (36%) wells analyzed in the Coyote Valley. Four wells had an upward concentration trend and 6 wells had a downward trend. The estimated magnitude of the trend, or rate of increase, for the 4 wells with upward trends ranged from 0.5 to 2.1 mg/L/year. The mean estimated rate of decrease for the 6 wells with downward trend is about 1 mg/L/year.

In Coyote Valley, most wells with downward trends are clustered along or near Coyote Creek, in the southeasterly portion of the valley. Wells with upward trends tend to occur more toward the western side of the valley away from Coyote Creek.

Llagas Subbasin

Groundwater nitrate trend was evaluated at 23 wells which draw water from only the shallow aquifer zone. Similar to other zones, the majority of wells (78%) did not indicate any trend for nitrate. Groundwater nitrate trends were detected at 5 (22%) of these wells. Two wells had an upward trend and 3 wells exhibited a decreasing trend. For the two wells having an upward trend, the mean estimated rate of increase is about 8 mg/L/year. The mean estimated rate of decrease, for sites having a downward trend, is 0.8 mg/L/year.

Among wells tapping the principal aquifer zone, nitrate trends were detected at 22 of 104 (21 %) sites. Six wells had an upward trend and 16 wells had a downward trend. Of the 6 wells having an upward trend, the estimate of magnitude of trend ranged from 0.5 to 2.3 mg/L/year with a mean rate of increase of about 0.6 mg/L/year. The mean estimated rate of decrease, for sites having a downward trend, is 1.2 mg/L/year.

In the Llagas Subbasin, the spatial location of wells with increasing and decreasing nitrate trends appear to be somewhat randomly located with no easily discernable pattern.

4.2.2 Trends for Chloride

There are several sources of chloride in the environment. These sources may be naturally occurring such as sea spray in coastal areas, bodies of saline water, connate water, and dissolution of evaporate deposits. Anthropogenic sources include wastewater disposal, various industrial processes, and the return of excess irrigation water to groundwater. An increase in chloride content is generally regarded as a deterioration of water quality.

Santa Clara Subbasin

Santa Clara Plain

Trend in chloride content were evaluated at 23 wells drawing from the shallow aquifer zone. The majority of wells (56%) did not show clear trends for chloride. Two wells had an upward concentration trend and 8 wells had a downward trend. Estimates of trend magnitude for the two wells having an upward trend were 0.03 and 0.15 mg/L/year. The median estimated rate of decrease, for sites having a downward trend, is 2 mg/L/year.

The vast majority of principal zone wells (97%) did not show a trend for chloride. Three of 116 (2.5%) wells drawing from the principal aquifer zone of the Santa Clara Plain study area had detectable trends in chloride content. One well had an upward trend and 2 wells had downward trends. An estimate of the magnitude of trend at the well having an upward trend was 17 mg/L/year. This well is located in the extreme southeastern portion of the Santa Clara Plain study area. The mean estimated rate of decrease, for sites having a downward trend, is 4 mg/L/year.

Most wells having a downward trend in chloride content are clustered in the region previously affected by saltwater intrusion in the northern portions of San Jose. However, in this same area, two wells were found to have increasing chloride trends.

Coyote Valley

No trends in chloride were detected at the 13 sites analyzed within the Coyote Valley study area.

Llagas Subbasin

The majority of wells tested in the shallow zone did not show a trend for chloride (89%). Upward trends in chloride were detected at 2 of 18 wells located within the shallow zone of the Llagas Subbasin. The estimated mean rate of increase is 3 mg/L/year. The two wells with upward trends in chloride content are located in the southern portions of Llagas Subbasin, although they are several miles apart. No downward trends in chloride content were observed from wells drawing from the shallow aquifer zone.

No trends in chloride were detected at the 31 wells tested which draw water from the principal aquifer zone within the Llagas Subbasin.

4.2.3 Trends for Total Dissolved Solids

Total Dissolved Solids (TDS) is a measure of the combined content of all inorganic and organic substances in a water sample. It is a prime indicator of the generally suitability of water, especially for domestic and municipal use. Dissolved solids in groundwater are related to the interaction of water with the atmosphere, soil, and rock. Although not considered a “primary” contaminant (one that is deemed to be associated with health effects), it is used as an indication of the aesthetic characteristic of drinking water. Dissolved solids in groundwater can be artificially elevated due to runoff, soil leaching, and land use.

Santa Clara Subbasin

Santa Clara Plain

Sixteen wells representing the shallow aquifer zone of the Santa Clara Plain study area were analyzed for TDS trend. The majority of wells (81%) did not indicate a trend, with only 2 wells having an upward trend and 1 well having a downward trend. The mean estimated rate of increase of the two wells having an upward trend is 77 mg/L/year. The estimated rate of decrease for the site having a downward trend is 56 mg/L/year. The well exhibiting the greatest rate of increase (112 mg/L/year) between 2001 and 2010 is a shallow saltwater intrusion monitoring well located adjacent to the Guadalupe River and just south of Highway 237. This is a significant increase that warrants additional study; District staff will evaluate potential causes for this increase to determine what additional action, if any, is needed.

Trends in TDS were detected at only 3 of 113 wells (3%) drawing from the principal aquifer zone of the Santa Clara Plain Study area, with 2 wells having an upward trend and 1 well having a downward trend. The mean estimated rate of increase of the two wells having an upward trend is 10 mg/L/year. The estimated rate of decrease, for the site having a downward trend, is 14 mg/L/year. No spatial pattern of trend results is observed.

Coyote Valley

Most wells in Coyote Valley do not indicate a trend for TDS. A statistically significant upward trend for TDS was detected at 1 of 10 sites in the Coyote Valley Study area. The magnitude of trend for this well was estimated at 19.8 mg/L/year. There were no wells with a statistically significant downward trend in the Coyote Valley Study area.

Llagas Subbasin

Twenty wells representing the shallow aquifer zone were analyzed for TDS trend, with only 1 well having an upward trend. The estimated rate of increase of the well having an upward trend is 17 mg/L/year. No trends in TDS were detected in 31 wells analyzed which draw water from the principal aquifer zone of the Llagas Subbasin.

Table 4-1. Summary of Mann-Kendall Trend Analysis Results, 2001 - 2010.

Constituent	Number of wells analyzed	Wells with upward trend	Range of up trend magnitude (mg/L/yr)	Wells with downward trend	Range of down trend magnitude (mg/L/yr)	Wells with no trend
Santa Clara Subbasin Santa Clara Plain – Shallow Aquifer Zone						
TDS	16	2	42 - 112	1	56	13
Chloride	23	2	0.03 – 0.15	8	1 – 140	13
Nitrate	16	1	0.8	0	--	15
Santa Clara Subbasin Santa Clara Plain – Principal Aquifer Zone						
TDS	113	2	10	1	14	110
Chloride	116	1	17	2	1.0 – 8.0	113
Nitrate	231	15	0.1 – 1.8	19	0.3 – 1.6	197
Santa Clara Subbasin - Coyote Valley						
TDS	13	1	18	0	--	12
Chloride	13	0	--	0	--	13
Nitrate	28	4	0.5 – 2.1	6	0.3 – 1.4	18
Llagas Subbasin – Shallow Aquifer Zone						
TDS	20	1	17	0	--	19
Chloride	18	2	2 – 4	0	--	16
Nitrate	23	2	6.6 – 10	3	0.3 – 1.4	18
Llagas Subbasin – Principal Aquifer Zone						
TDS	31	0	--	0	--	31
Chloride	31	0	--	0	--	31
Nitrate	104	6	0.5 – 2.3	16	0.3 – 6.5	82

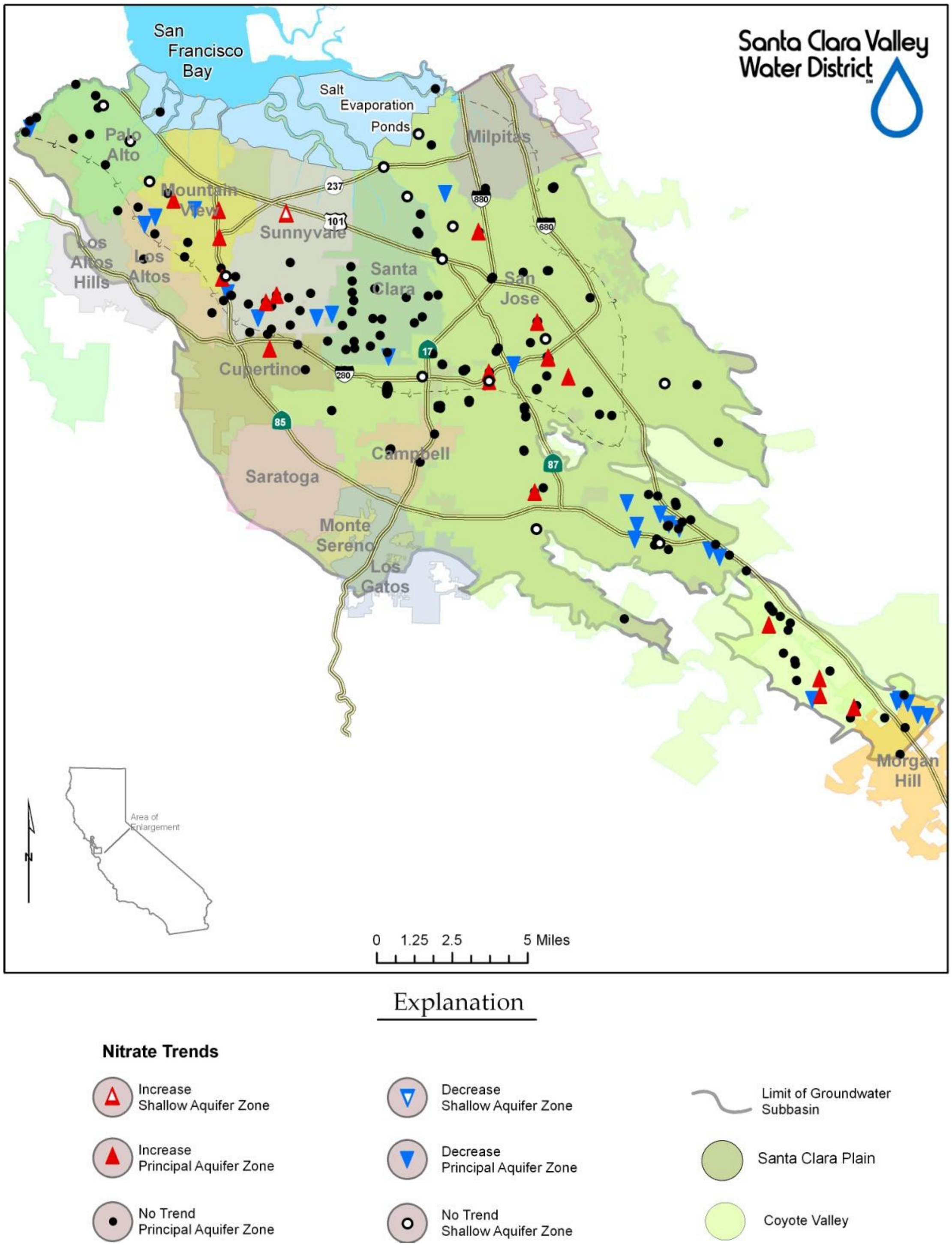

Figure 4-1. Nitrate Trends in Groundwater, Santa Clara Subbasin, 2001 - 2010

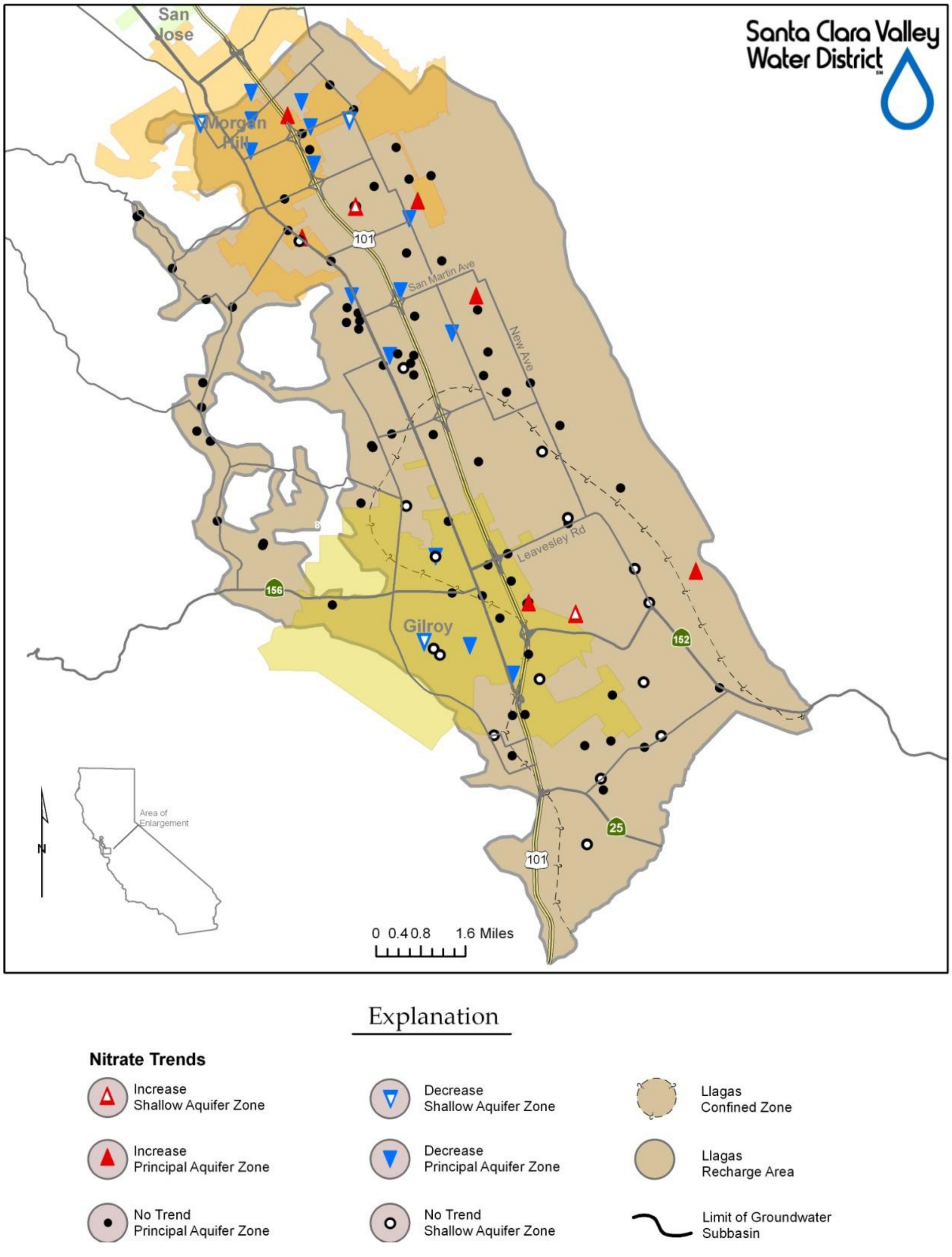
Santa Clara Valley Water District
San Jose
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
156
Gilroy
152
25
101
Area of Enlargement
N
0 0.4 0.8 1.6 Miles
Explanation
Nitrate Trends
Increase Shallow Aquifer Zone
Increase Principal Aquifer Zone
No Trend Principal Aquifer Zone
Decrease Shallow Aquifer Zone
Decrease Principal Aquifer Zone
No Trend Shallow Aquifer Zone
Llagas Confined Zone
Llagas Recharge Area
Limit of Groundwater Subbasin

Figure 4-2. Nitrate Trends in Groundwater, Llagas Subbasin, 2001 – 2010.

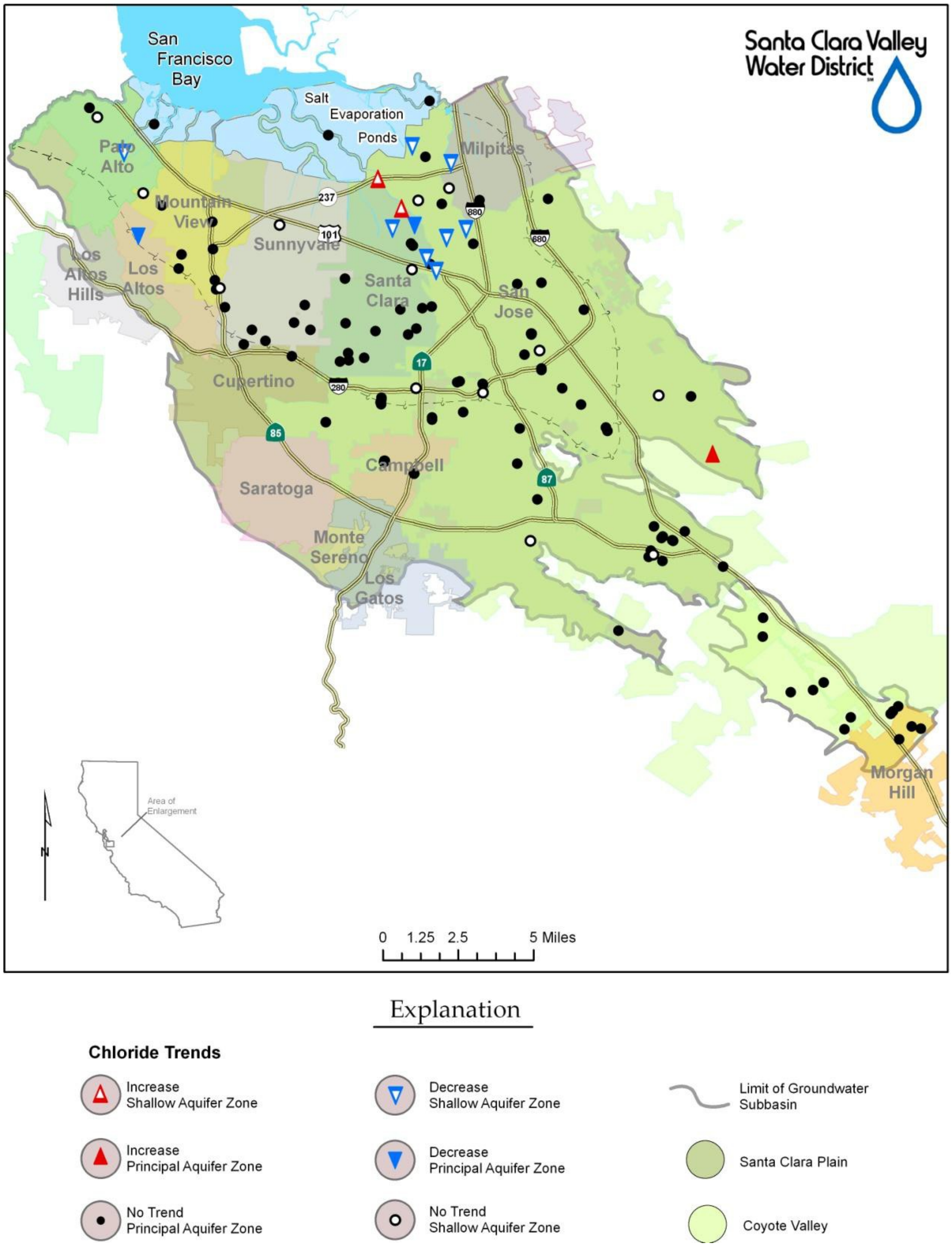

Figure 4-3. Chloride Trends in Groundwater, Santa Clara Subbasin, 2001 – 2010.

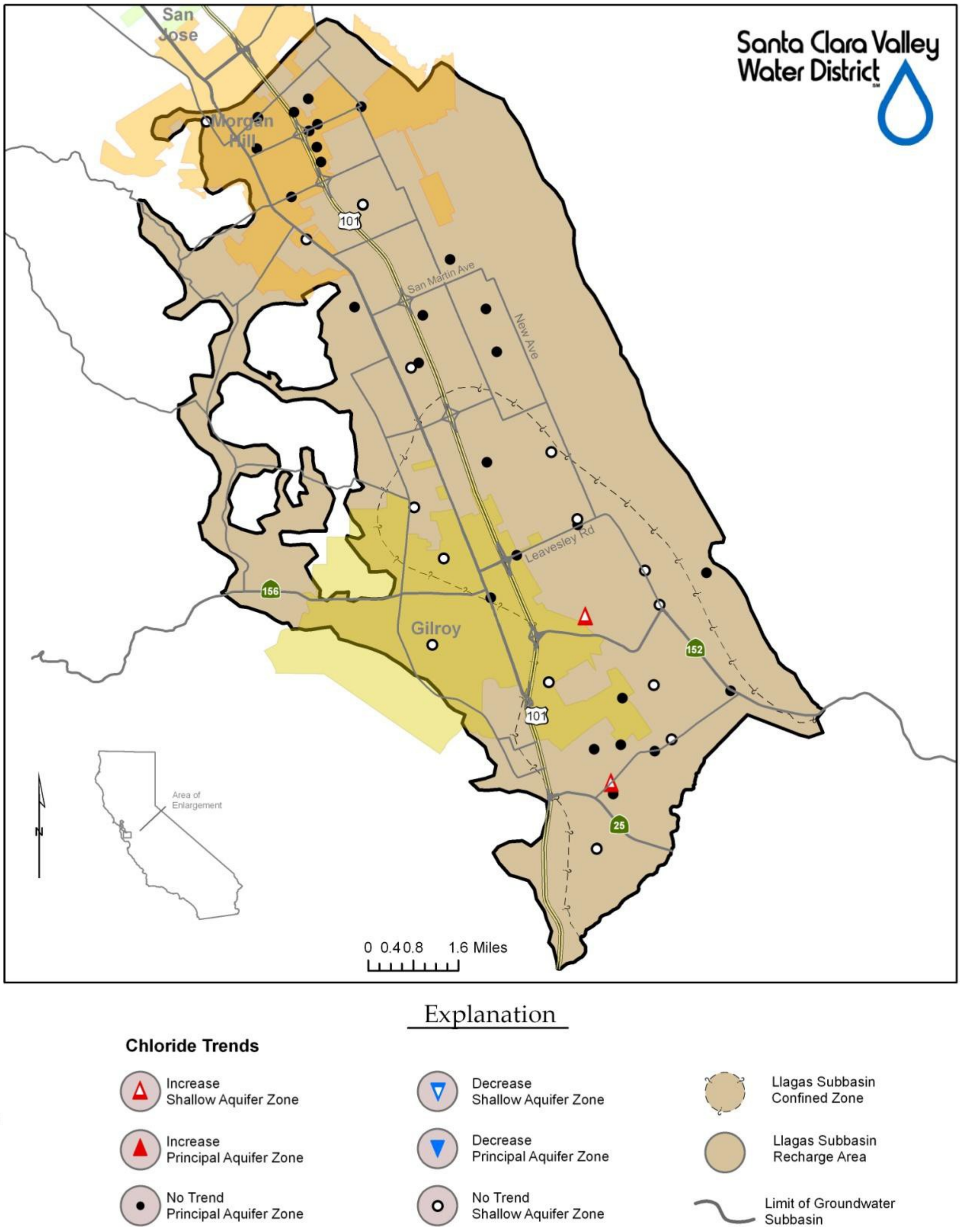
San Jose
Santa Clara Valley Water District
Morgan Hill
101
San Martin Ave
New Ave
Leavesley Rd
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.4 0.8 1.6 Miles
Explanation
Chloride Trends
Increase Shallow Aquifer Zone
Increase Principal Aquifer Zone
No Trend Principal Aquifer Zone
Decrease Shallow Aquifer Zone
Decrease Principal Aquifer Zone
No Trend Shallow Aquifer Zone
Llagas Subbasin Confined Zone
Llagas Subbasin Recharge Area
Limit of Groundwater Subbasin

Figure 4-4. Chloride Trends in Groundwater, Llagas Subbasin, 2001 – 2010.

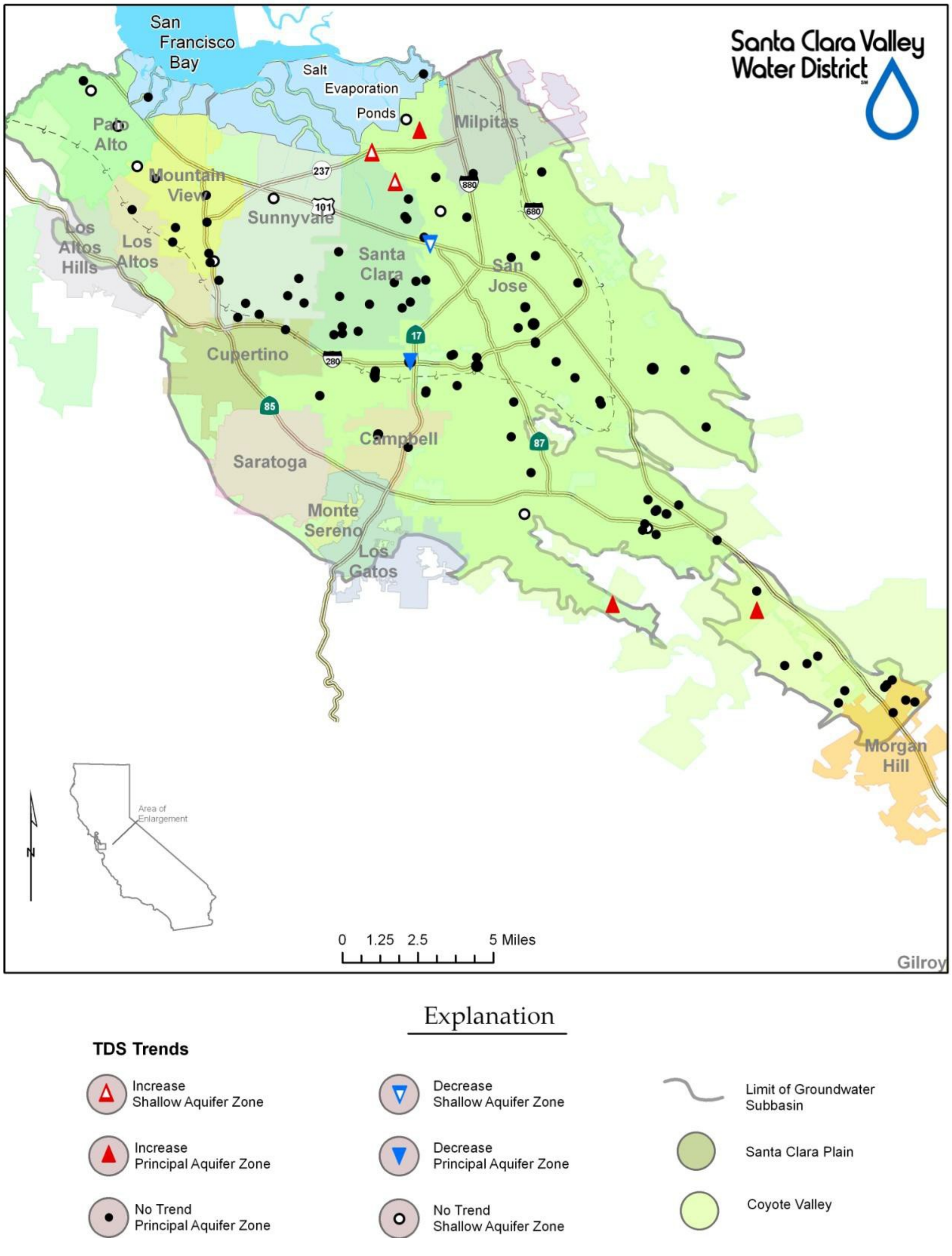

Figure 4-5. Total Dissolved Solids Trends in Groundwater, Santa Clara Subbasin, 2001 - 2010

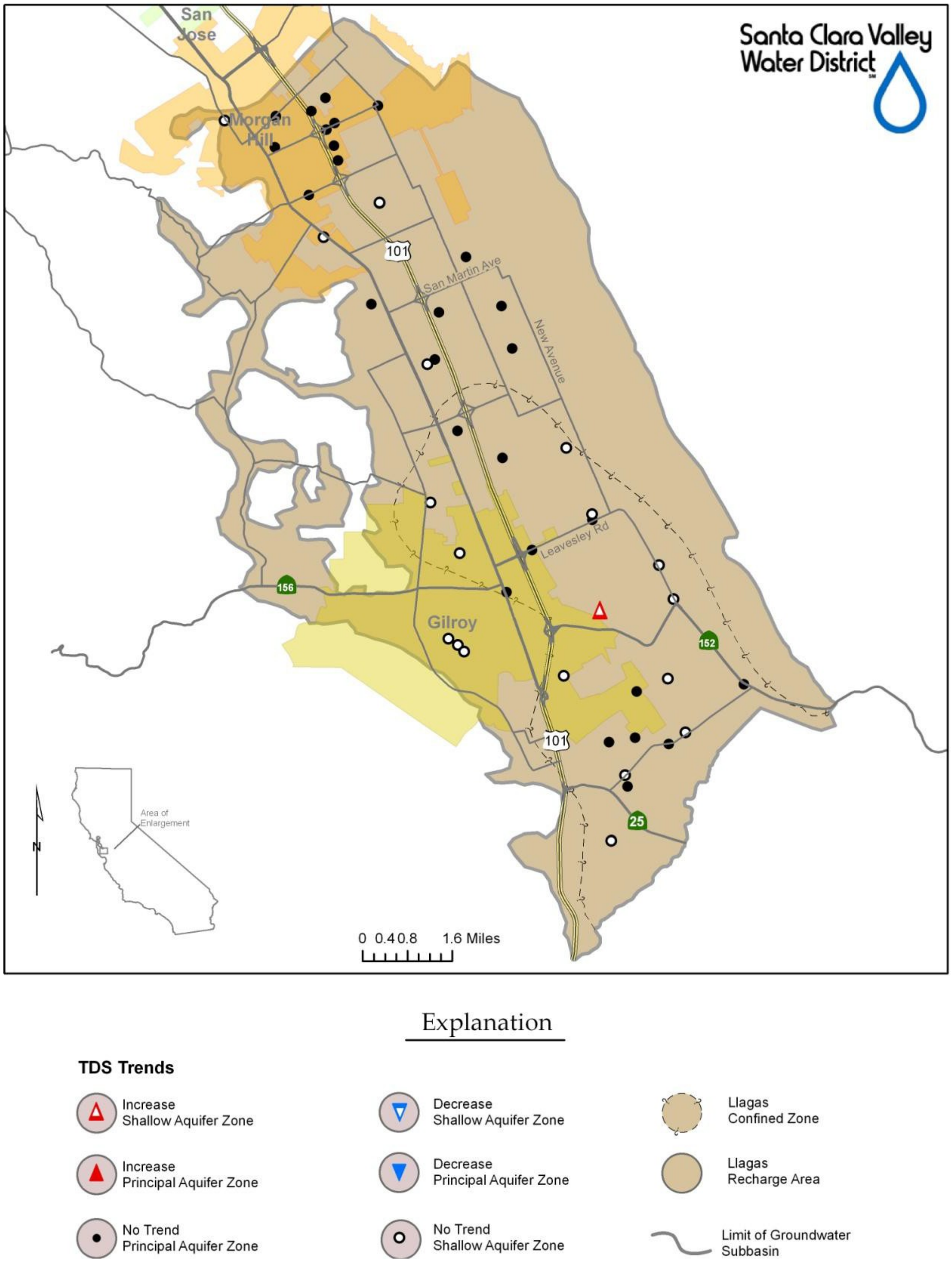
San Jose
Santa Clara Valley Water District
Morgan Hill
101
San Martin Ave
New Avenue
Leavesley Rd
156
Gilroy
152
101
25
Area of Enlargement
N
0 0.4 0.8 1.6 Miles
Explanation
TDS Trends
Increase Shallow Aquifer Zone
Increase Principal Aquifer Zone
No Trend Principal Aquifer Zone
Decrease Shallow Aquifer Zone
Decrease Principal Aquifer Zone
No Trend Shallow Aquifer Zone
Llagas Confined Zone
Llagas Recharge Area
Limit of Groundwater Subbasin

Figure 4-6. Total Dissolved Solids Trends in Groundwater, Llagas Subbasin, 2001 – 2010.

5.0 2010 Groundwater Quality Monitoring Summary

As part of the District's groundwater quality monitoring program, analytical results from samples collected by the District and water suppliers in calendar year 2010 were evaluated in relation to drinking water standards and agricultural objectives. In addition, temporal trends in water quality were analyzed for nitrate, TDS, and chloride. Water quality indicators, major and minor ions, trace elements, volatile and non-volatile organic compounds (pesticides) were analyzed in as many as 294 wells comprised of mostly municipal or domestic supply wells with a smaller number of dedicated monitoring wells. The majority of wells within Santa Clara County produce high-quality water that meets drinking water standards, and the continued evaluation of regional quality and potential threats helps to ensure high-quality groundwater will continue to be available.

Table 5-1 summarizes which constituents were detected above primary, health-based standards (Maximum Contaminant Levels, or MCLs) in 2010. These include aluminum, nitrate, and perchlorate. For the wells analyzed in this report, primary drinking water standards were exceeded at the following percentage of wells tested: nitrate (8%); perchlorate (<2%); and aluminum (<2%). Detections above MCLs occurred at both monitoring wells and water supply wells.

For the wells analyzed in this report, secondary standards were exceeded at the following percentage of wells tested: TDS (19%), manganese (9.6%), specific conductance (17%), iron (11%), chloride (<1%), turbidity (<2%), aluminum (<2%), and color (<2%). It should be noted that the drinking water standards for some constituents, such as TDS, are given as a range by CDPH. For these constituents, the lowest value (recommended limit) was used in this analysis.

Groundwater quality was also evaluated against established agricultural objectives from the appropriate Regional Board Basin Plans. The most common exceedance of agricultural objectives in the Santa Clara Subbasin was for nitrate; the objective was exceeded in 7% of the shallow zone wells and 23% of the principal zone wells. The other constituents detected above agricultural objectives included boron, chloride, copper, iron, manganese, specific conductance, nitrate + nitrite, and SAR. In the Llagas Subbasin, the Central Coast RWQCB's lowest specific conductance objective was exceeded at 28% of wells tested. However, no wells were found to have specific conductance greater than the upper limit at which point severe problems would be expected to occur. The other constituents detected above agricultural objectives in the two subbasins were bicarbonate, boron, chloride, copper, iron, manganese, nitrate, and nitrate + nitrite, and SAR.

County-wide trend analyses for TDS, chloride, and nitrate were conducted for 193, 201, and 402 well sites, respectively using ten years of data (2001-2010). The majority of wells analyzed for trend did not indicate any statistically significant trend. For the wells analyzed county-wide for trend, there were upward trends for the following percentages of wells: nitrate (7%), TDS (3%), and chloride (2.5%). For the wells analyzed county-wide for trend, there were downward trends for the following percentages of wells: nitrate (11%), chloride (2.5%), and TDS (1%). The remaining wells (majority of wells) did not indicate convincing evidence of trend. Trends varied by subbasin and zone as shown in Table 5-2.

In the Santa Clara Plain and Coyote Valley, the location of wells with detectable nitrate and chloride trends did not appear to be entirely random with some areas marked by wells having generally consistent trend results. In the Llagas Subbasin, no easily discernable pattern of nitrate trend results was evident while trends of TDS and chloride were too few in number to attempt to discern any pattern. District staff will continue to perform trend analysis for select constituents that may provide early warning of potential groundwater degradation.

Analysis of 2010 groundwater quality data from monitoring performed by the District and water suppliers indicates that groundwater in Santa Clara County generally meets drinking water standards without the need for treatment. However, some impacts are noted, including elevated nitrate in portions of Coyote Valley and the Llagas Subbasin and a small number of exceedances for perchlorate and aluminum. With regard to secondary, aesthetic standards, elevated levels of total dissolved solids, specific conductance, manganese and iron were detected at various wells throughout the County. These elevated concentrations present some challenges to water suppliers or well owners, who may need to blend or treat the water prior to delivery or use.

The District will continue to collect and analyze groundwater quality data to characterize regional groundwater quality, determine the severity and extent of contamination, evaluate changes in water quality over time, and identify potential threats to help ensure the groundwater basins are protected from contamination and the threat of contamination.

Understanding the quality of groundwater and potential degradation or adverse trends allows the District to better understand individual threats and pursue appropriate action to protect groundwater quality. These actions may include:

- Performing additional analysis to determine possible causes and remedies to address potentially adverse conditions or trends.
- Conducting public outreach to raise awareness of groundwater protection.
- Coordinating with regulatory agencies to pursue the timely restoration of degraded groundwater.
- Developing strategies to address ongoing loading of salts and nutrients, like nitrate.
- Working with local cities and the county to ensure land use activities do not adversely impact groundwater resources.
- Efforts to influence statewide legislation and policy to ensure groundwater resources are aggressively protected.

Table 5-1. Wells with Constituents Exceeding Primary Drinking Water Standards in 2010

Subbasin	Study Area and Zone	Constituent	Notes
Santa Clara Subbasin	Santa Clara Plain Shallow Zone	None	None
	Santa Clara Plain Principal Zone	Aluminum Nitrate	Aluminum was detected above the MCL at two public water supply wells. Subsequent testing did not confirm the elevated level at one of the wells. Nitrate was detected above the MCL at one private water supply well used mostly for irrigation.
	Coyote Valley	Aluminum Nitrate	Aluminum was detected above the MCL at one public water supply well. Nitrate was detected above the MCL at 2 water supply wells (one public supply well and one private domestic supply well).
Llagas Subbasin	Shallow Zone	Nitrate	Nitrate was detected above the MCL at 8 monitoring wells and 2 private domestic supply wells.
	Principal Zone	Nitrate Perchlorate	Nitrate was detected above the MCL at 9 water supply wells (4 public). Perchlorate was detected above the MCL at 2 public water supply wells.

Note: Public water systems must meet drinking water standards. For constituents detected above primary drinking water standards, this may require blending or treatment by the water supplier prior to delivery to customers.

Table 5-2. Summary of Trend Analyses (2001-2010)

Constituent	Number of Wells Analyzed[1]	Percent of Wells with Increasing Trends	Percent of Wells with Decreasing Trends	Percent of Wells with no Apparent Trend
Santa Clara Subbasin Santa Clara Plain, Shallow Aquifer Zone				
Total Dissolved Solids	16	13%	6%	81%
Chloride	23	9%	35%	56%
Nitrate	16	6%	0%	94%
Santa Clara Subbasin Santa Clara Plain, Principal Aquifer Zone				
Total Dissolved Solids	113	2%	1%	97%
Chloride	116	1%	2%	97%
Nitrate	231	6%	8%	85%
Santa Clara Subbasin Coyote Valley				
Total Dissolved Solids	13	8%	0%	92%
Chloride	13	0%	0%	100%
Nitrate	28	14%	21%	64%
Llagas Subbasin Shallow Aquifer Zone				
Total Dissolved Solids	20	5%	0%	95%
Chloride	18	11%	0%	89%
Nitrate	23	9%	13%	78%
Llagas Subbasin Principal Aquifer Zone				
Total Dissolved Solids	31	3%	0%	97%
Chloride	31	0%	0%	100%
Nitrate	104	6%	15%	79%

Notes:

1. The number of wells tested for trend for each constituent and each zone varies, and was based on the availability of results for each constituent. A minimum of four results between 2000 and 2009 was required for the well to be included in the trend testing for a given constituent.

6.0 Appendices

Appendix A – List of Parameters Analyzed by SCVWD

Constituent	Analytical Method	Parameter Code	Unit
1,1,1,2-TETRACHLORETHANE	EPA 524.2	77562	µg/L
1,1,1-TRICHLOROETHANE	EPA 524.2	34506	µg/L
1,1,2,2-TETRACHLOROETHANE	EPA 524.2	34516	µg/L
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	EPA 524.2	81611	µg/L
1,1,2-TRICHLOROETHANE	EPA 524.2	34511	µg/L
1,1-DICHLOROETHANE	EPA 524.2	34496	µg/L
1,1-DICHLOROETHYLENE	EPA 524.2	34501	µg/L
1,1-DICHLOROPROPENE	EPA 524.2	77168	µg/L
1,2,3-TRICHLOROBENZENE	EPA 524.2	77613	µg/L
1,2,3-TRICHLOROPROPANE	EPA 524.2	77443	µg/L
1,2,4-TRICHLOROBENZENE	EPA 524.2	34551	µg/L
1,2,4-TRIMETHYLBENZENE	EPA 524.2	77222	µg/L
1,2-DICHLOROBENZENE	EPA 524.2	34536	µg/L
1,2-DICHLOROETHANE	EPA 524.2	34531	µg/L
1,2-DICHLOROPROPANE	EPA 524.2	34541	µg/L
1,3,5-TRIMETHYLBENZENE	EPA 524.2	77226	µg/L
1,3-DICHLOROBENZENE	EPA 524.2	34566	µg/L
1,3-DICHLOROPROPANE	EPA 524.2	77173	µg/L
1,3-DICHLOROPROPENE (TOTAL)	EPA 524.2	34561	µg/L
1,4-DICHLOROBENZENE	EPA 524.2	34571	µg/L
1-PHENYLPROPANE (N-PROPYLBENZENE)	EPA 524.2	77224	µg/L
2,2-DICHLOROPROPANE	EPA 524.2	77170	µg/L
2-CHLOROTOLUENE	EPA 524.2	A-008	µg/L
4-CHLOROTOLUENE	EPA 524.2	A-009	µg/L
ALKALINITY (TOTAL) AS CACO3	SM 2320 B	00410	mg/L
ALKALINITY-BICARBONATE (AS CaCO3)	SM 2320 B	00425	mg/L
ALUMINUM	EPA 200.7	01105	µg/L
BARIUM	EPA 200.7	01007	µg/L
BENZENE	EPA 524.2	34030	µg/L
BORON	EPA 200.7	01020	µg/L
BROMIDE	EPA 300.0	82298	mg/L
BROMOBENZENE	EPA 524.2	81555	µg/L
BROMOCHLOROMETHANE	EPA 524.2	A-012	µg/L
BROMODICHLOROMETHANE (THM)	EPA 524.2	32101	µg/L
BROMOFORM (THM)	EPA 524.2	32104	µg/L
BROMOMETHANE	EPA 524.2	34413	µg/L
CALCIUM	EPA 200.7	00916	mg/L
CALCIUM AS CACO3	EPA 200.7	00910	mg/L
CARBON TETRACHLORIDE	EPA 524.2	32102	µg/L
CARBONATE ALKALINITY	SM 2320 B	00445	mg/L
CHLORIDE	SM 4500-Cl D	00940	mg/L
CHLOROETHANE	EPA 524.2	34311	µg/L
CHLOROFORM (THM)	EPA 524.2	32106	µg/L
CHLOROMETHANE	EPA 524.2	34418	µg/L
CIS-1,2-DICHLOROETHYLENE	EPA 524.2	77093	µg/L
CIS-1,3-DICHLOROPROPENE	EPA 524.2	34704	µg/L
DIBROMOCHLOROMETHANE (THM)	EPA 524.2	32105	µg/L
DIBROMOMETHANE	EPA 524.2	77596	µg/L
DICHLORODIFLUOROMETHANE (FREON 12)	EPA 524.2	34668	µg/L
DICHLOROMETHANE	EPA 524.2	34423	µg/L
DIISOPROPYL ETHER	EPA 524.2	A-036	µg/L
ETHYLBENZENE	EPA 524.2	34371	µg/L
ETHYL-TERT-BUTYL ETHER	EPA 524.2	A-033	µg/L
FLUORIDE (NATURAL SOURCE)	EPA 300.0	00951	mg/L
HEXACHLOROBUTADIENE	EPA 524.2	34391	µg/L

Constituent	Analytical Method	Parameter Code	Unit
HYDROXIDE ALKALINITY	SM 2320 B	71830	mg/L
IRON	EPA 200.7	01045	µg/L
ISOPROPYLBENZENE	EPA 524.2	77223	µg/L
MAGNESIUM	EPA 200.7	00927	mg/L
METHYL-TERT-BUTYL-ETHER (MTBE)	EPA 524.2	46491	µg/L
MONOCHLOROBENZENE	EPA 524.2	34301	µg/L
M-P-XYLENE	EPA 524.2	A-014	µg/L
NAPHTHALENE	EPA 524.2	34696	µg/L
N-BUTYLBENZENE	EPA 524.2	A-010	µg/L
NITRATE (AS NO3)	EPA 300.0	71850	mg/L
O-XYLENE	EPA 524.2	77135	µg/L
PERCHLORATE	EPA 314.0	A-031	µg/L
PH- LABORATORY	SM 4500-H+	00403	pH units
PHOSPHATE- ORTHO	EPA 300.0	00660	mg/L
P-ISOPROPYLTOLUENE	EPA 524.2	A-011	µg/L
POTASSIUM	EPA 200.7	00937	mg/L
SEC-BUTYLBENZENE	EPA 524.2	77350	µg/L
SILICA	EPA 200.7	00955	mg/L
SODIUM	EPA 200.7	00929	mg/L
SPECIFIC CONDUCTANCE	SM 2510 B	00095	µmhos
STYRENE	EPA 524.2	77128	µg/L
SULFATE	EPA 300.0	00945	mg/L
TERT-AMYL-METHYL ETHER	EPA 524.2	A-034	µg/L
TERT-BUTYL ALCOHOL	EPA 524.2	77035	µg/L
TERT-BUTYLBENZENE	EPA 524.2	77353	µg/L
TETRACHLOROETHYLENE	EPA 524.2	34475	µg/L
TOLUENE	EPA 524.2	34010	µg/L
TOTAL FILTERABLE RESIDUE @ 180 C (TDS)	SM 2540 C	70300	mg/L
TRANS-1,2-DICHLOROETHYLENE	EPA 524.2	34546	µg/L
TRANS-1,3-DICHLOROPROPENE	EPA 524.2	34699	µg/L
TRICHLOROETHYLENE	EPA 524.2	39180	µg/L
TRICHLOROFLUOROMETHANE (FREON 11)	EPA 524.2	34488	µg/L
VINYL CHLORIDE	EPA 524.2	39175	µg/L
XYLENES (TOTAL)	EPA 524.2	81551	µg/L
ZINC	EPA 200.7	01092	µg/L

Table B-1. Summary of 2010 Water Quality Indicator Data

Constituent		Santa Clara Subbasin - Santa Clara Plain								Santa Clara Subbasin - Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone				Principal Zone								Shallow Zone				Principal Zone					
	Units	Number of results[1]	Min[2]	Median[3]	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	MCL[4]	SMCL[5]
Alkalinity – Total as $CaCO_3$	mg/L	14	174	288	550	65	120	230	400	18	150	200	353	21	108	221	379	33	100	192	347	--	--
Alkalinity – Carbonate as $CaCO_3$	mg/L	14	<2	<2	<2	65	<2	<5	<5	18	<2	<2	<5	21	0	0	0	33	0	<5	<5	--	--
Alkalinity – Bicarbonate as $CaCO_3$	mg/L	13	174	359	550	7	188	279	359	9	150	192	353	21	108	221	379	20	127	210	347	--	--
Alkalinity – Hydroxide as $CaCO_3$	mg/L	14	<2	<2	<2	65	<1	<1	<2	18	<1	<2	<2	21	0	0	0	32	<1	<1	<1	--	--
Aggressive Index	––	1	12	12	12	58	9.99	12	13	9	11.89	12	12.11	0	--	--	--	13	11.43	11.97	13	--	--
Caffeine	µg/L	1	<0.05	<0.05	<0.05	34	<0.05	<0.05	<0.05	2	<0.05	<0.05	<0.05	0	--	--	--	0	--	--	--	--	--
Color	Color Units	1	<3	<3	<3	58	<3	<5	6	9	<3	<5	20	0	--	--	--	13	<5	<5	<5	--	15
Foaming Agents (MBAS)	µg/L	1	<0.05	<0.05	<0.05	58	<0.05	<0.05	0.098	9	<0.05	<0.05	<0.05	0	--	--	--	12	<0.05	<0.05	0.05	--	0.5
Hardness as $CaCO_3$	mg/L	1	290	290	290	58	150	290	527	9	192	260	337	0	--	--	--	13	180	239	351	--	--
Langelier Index at 60 C	--	1	0.79	0.79	0.79	29	-0.16	0.9	1.4	5	-0.16	-0.16	0.69	0	--	--	--	1	0.82	0.82	0.82	--	--
Langelier Index at Source Temperature	--	0	--	--	--	28	-2.04	-0.62	0.69	0	--	--	--	0	--	--	--	0	--	--	--	--	--
Odor Threshold @ 60 C	TON	1	<1	<1	<1	57	<1	<1	1	8	<1	<1	1	0	--	--	--	13	<1	<1	<1	--	3
pH - Laboratory	pH Units	14	6.9	7.4	8.8	65	6.2	7.6	8.0	18	7.0	7.6	7.9	21	6.8	7.2	7.8	33	7	7.41	8.3	--	6.5 – 8.5
pH - Field	pH Units	0	--	--	--	57	6.5	7.5	8.4	0	--	--	--	0	--	--	--	0	--	--	--	--	6.5 – 8.5
Source Temperature	C	0	--	--	--	40	15	18.5	23.2	0	--	--	--	0	--	--	--	0	--	--	--	--	--
Specific Conductance	µS/cm	14	510	809	3,480	96	465	685	1,200	22	449	585	1,150	21	274	738	1,280	157	340	540	1,100	--	900 (1,600)
Turbidity	NTU	1	0.1	0.1	0.1	60	<0.1	0.19	4.1	9	<0.1	0.35	81	0	--	--	--	13	<0.1	0.12	0.67	--	5

Notes: mg/l = milligrams per liter; µS/cm = microSiemens per centimeter; NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number; min = minimum; Max = maximum;
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
3. For data sets containing detected values above and below multiple reporting limits, the median was computed by first re-censoring the data to the highest detection limit, then proceeding in accordance with methods outlined on pages 363 to 365 of "*Statistical Methods in Water Resources",* by D.R. Helsel and R.M. Hirsch, 1992.
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

Table B-2. Summary of 2010 Volatile Organic Compound (VOC) Data

Constituent		Santa Clara Subbasin - Santa Clara Plain						Santa Clara Subbasin - Coyote Valley			Llagas Subbasin						Maximum Contaminant Levels	
		Shallow Zone			Principal Zone						Shallow Zone			Principal Zone				
	Units	Number of results[1]	Result[2]	RL[3]	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	MCL[4]	SMCL[5]
1,1,1,2-Tetrachlorethane	µg/L	17	ND	<0.5	52	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,1,1-Trichloroethane	µg/L	17	D	<0.5	131	D	<0.5	15	ND	<0.5	21	D	<0.5	61	ND	<0.5	200	--
1,1,2,2-Tetrachloroethane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	1	--
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	µg/L	17	D	<10	131	D	<10	15	D	<10	21	ND	<0.5	61	D	<10	1,200	--
1,1,2-Trichloroethane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
1,1-Dichloroethane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
1,1-Dichloroethene	µg/L	17	ND	<0.5	131	D	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	6	--
1,1-Dichloropropene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,2,3-Trichlorobenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,2,3-Trichloropropane	µg/L	13	ND	<0.5	31	ND	<0.5	9	ND	<0.5	21	ND	<0.5	37	ND	<0.5	--	--
1,2,4-Trichlorobenzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
1,2,4-Trimethylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,2-Dichlorobenzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	600	--
1,2-Dichloroethane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	0.5	--
1,2-Dichloropropane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
1,3,5-Trimethylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,3-Dichlorobenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,3-Dichloropropane	µg/L	17	ND	<0.5	58	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
1,3-Dichloropropene (Total)	µg/L	17	ND	<0.5	124	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	0.5	--
1,4-Dichlorobenzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
1-Phenylpropane (n-propylbenzene)	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
2,2-Dichloropropane	µg/L	17	ND	<0.5	38	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
2,4-Dinitrotoluene	µg/L	2	ND	<0.1	34	ND	<0.1	2	ND	<0.1	0	NA	--	0	NA	--	--	--
2-Chlorotoluene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
4-Chlorotoluene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Acetone	µg/L	0	NA	--	1	ND	<5	0	NA	--	0	NA	--	4	ND	<10	--	--
Acrylonitrile	µg/L	0	NA	--	1	ND	<5	0	NA	--	0	NA	--	0	NA	--	--	--
Benzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	1	--
Benzo (a) pyrene	µg/L	2	ND	<0.1	55	ND	<0.1	9	ND	<0.1	0	NA	--	12	ND	<0.1	0.2	--
Bromobenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Bromochloroacetic Acid (BCAA)	µg/L	0	NA	--	12	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
Bromochloromethane	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Bromodichloromethane (THM)	µg/L	17	ND	<1	51	ND	<1	10	ND	<1	21	ND	<0.5	49	ND	<1	--	--
Bromoform (THM)	µg/L	17	ND	<1	51	ND	<1	10	ND	<1	21	ND	<0.5	49	D	<1	--	--
Bromomethane	µg/L	17	D	<0.5	38	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--

Table B-2. Summary of 2010 Volatile Organic Compound (VOC) Data

Constituent		Santa Clara Subbasin - Santa Clara Plain						Santa Clara Subbasin Coyote Valley			Llagas Subbasin						Maximum Contaminant Levels	
		Shallow Zone			Principal Zone						Shallow Zone			Principal Zone				
	Units	Number of results[1]	Result[2]	RL[3]	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	MCL[4]	SMCL[5]
Carbon Disulfide	µg/L	4	ND	<0.5	31	ND	<0.5	1	ND	<0.5	0	NA	--	0	NA	--	--	--
Carbon Tetrachloride	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	0.5	--
Chloroethane	µg/L	17	ND	<0.5	38	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Chloroform (THM)	µg/L	17	ND	<1	51	D	<1	10	ND	<1	21	D	<0.5	49	ND	<1	--	--
Chloromethane	µg/L	17	ND	<0.5	38	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
cis-1,2-dichloroethene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	6	--
Di(2-ethylhexyl)adipate	µg/L	2	ND	<5	55	ND	<5	9	ND	<5	0	NA	--	12	ND	<5	400	--
Di(2-ethylhexyl)phthalate	µg/L	2	ND	<3	55	D	<3	9	ND	<3	0	NA	--	12	ND	<3	4	--
Dibromoacetic Acid	µg/L	0	NA	--	12	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
Dibromochloromethane (THM)	µg/L	17	ND	<1	51	ND	<1	10	ND	<1	21	ND	<0.5	49	ND	<1	--	--
Dibromochloropropane (DBCP)	µg/L	2	ND	<0.01	56	ND	<0.01	10	ND	<0.01	0	NA	--	12	ND	<0.01	0.2	--
Dibromomethane	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Dichloroacetic Acid	µg/L	0	NA	--	12	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
Dichlorodifluoromethane (Freon 12)	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Dichloromethane	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
Diisopropyl Ether	µg/L	17	ND	<3	37	ND	<3	10	ND	<3	21	ND	<3	45	ND	<3	--	--
Ethylbenzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	300	--
Ethylene Dibromide (EDB)	µg/L	2	ND	<0.02	56	ND	<0.02	10	ND	<0.02	0	NA	--	12	ND	<0.02	0.05	--
Ethyl-Tert-Butyl Ether	µg/L	17	ND	<3	37	ND	<3	10	ND	<3	21	ND	<0.5	49	ND	<3	--	--
Haloacetic Acids (5) (HAA5)	µg/L	0	NA	--	12	ND	<2	0	NA	--	0	NA	--	0	NA	--	60	--
Hexachlorobutadiene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Isopropylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
M,P-xylene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Methyl Ethyl Ketone (MEK, Butanone)	µg/L	4	ND	<5	40	ND	<5	1	ND	<5	0	NA	--	29	ND	<10	--	--
Methyl Isobutyl Ketone	µg/L	4	ND	<5	44	ND	<5	1	ND	<5	0	NA	--	29	ND	<10	--	--
Methyl-Tert-Butyl-Ether (MTBE)	µg/L	17	ND	<3	134	ND	<3	19	ND	<3	21	ND	<3	72	ND	<3	13	5
Monobromoacetic Acid (MBAA)	µg/L	0	NA	--	12	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
Monochloroacetic Acid (MCAA)	µg/L	0	NA	--	12	ND	<2	0	NA	--	0	NA	--	0	NA	--	--	--
Monochlorobenzene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	70	--
Naphthalene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
N-Butylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
O-Xylene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
PCB-1016	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
PCB-1221	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--

Table B-2. Summary of 2010 Volatile Organic Compound (VOC) Data

Constituent		Santa Clara Subbasin - Santa Clara Plain						Santa Clara Subbasin - Coyote Valley			Llagas Subbasin						Maximum Contaminant Levels	
		Shallow Zone			Principal Zone						Shallow Zone			Principal Zone				
	Units	Number of results[1]	Result[2]	RL[3]	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	MCL[4]	SMCL[5]
PCB-1232	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
PCB-1242	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
PCB-1248	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
PCB-1254	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
PCB-1260	µg/L	2	ND	<0.5	51	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	--	--
P-isopropyltoluene	µg/L	17	ND	<0.5	38	ND	<0.5	10	ND	<0.5	21	ND	<0.5	24	ND	<0.5	--	--
Polychlorinated Biphenyls (Total PCB's)	µg/L	2	ND	<0.5	55	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	0.5	--
Sec-Butylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Styrene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	100	--
Tert-Amyl-Methyl Ether (TAME)	µg/L	17	ND	<3	37	ND	<3	10	ND	<3	21	ND	<0.5	49	ND	<3	--	--
Tert-Butyl Alcohol (TBA)	µg/L	13	ND	<0.5	7	ND	<0.5	9	ND	<0.5	21	ND	<0.5	43	ND	<2	--	--
Tert-butylbenzene	µg/L	17	ND	<0.5	51	ND	<0.5	10	ND	<0.5	21	ND	<0.5	49	ND	<0.5	--	--
Tetrachloroethene (PCE)	µg/L	17	ND	<0.5	130	D	<0.5	15	ND	<0.5	21	ND	<0.5	61	D	<0.5	5	--
Toluene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	150	--
Total Trihalomethanes	µg/L	4	ND	<0.5	32	D	<0.5	1	ND	<0.5	0	NA	--	0	NA	--	80	--
Trans-1,2-Dichloroethene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	10	--
Trichloroacetic Acid	µg/L	0	NA	--	12	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
Trichloroethene	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	5	--
Trichlorofluoromethane (Freon 11)	µg/L	17	ND	<5	131	ND	<5	15	ND	<5	21	ND	<0.5	61	ND	<5	150	--
Vinyl Chloride	µg/L	17	ND	<0.5	131	ND	<0.5	15	ND	<0.5	21	ND	<0.5	61	ND	<0.5	0.5	--
Xylenes (Total)	µg/L	17	ND	<1	118	ND	<1	15	ND	<1	21	ND	<0.5	36	ND	<0.5	1,750	--

Notes: µg/l = micrograms per liter
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. ND= not detected above laboratory reporting limit. NA = not analyzed. D = detection above reporting limit.
3. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown.
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

Table B-3. Summary of Detected Volatile Organic Compounds (VOCs) - 2010

Constituent		Santa Clara Subbasin - Santa Clara Plain								Santa Clara Subbasin – Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone				Principal Zone								Shallow Zone				Principal Zone					
	Units	Number of results[1]	Min[2]	Median[3]	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	MCL[4]	SMCL[5]
1-1-1-Trichloroethane	µg/L	17	<0.5	<0.5	2.1	131	<0.5	<0.5	4.3	15	<0.5	<0.5	<0.5	21	<0.5	<0.5	0.8	61	<0.5	<0.5	<0.5	200	--
1-1-2-Trichloro-1-2-2-Trifluoroethane (Freon 113)	µg/L	17	<0.5	<0.5	4.64	131	<0.5	<10	18	15	<0.5	<0.5	0.87	21	<0.5	<0.5	<0.5	61	<0.5	<0.5	0.76	1,200	--
1-1-Dichloroethene	µg/L	17	<0.5	<0.5	<0.5	131	<0.3	<0.5	5.7	15	<0.5	<0.5	<0.5	21	<0.5	<0.5	<0.5	61	<0.5	<0.5	<0.5	6	--
Bromoform (THM)	µg/L	17	<0.5	<1	<1	51	<0.5	<1	<1	10	<0.5	<0.5	<1	21	<0.5	<0.5	<0.5	49	<0.5	<1	3.6	--	--
Bromomethane	µg/L	17	<0.5	<0.5	0.63	38	<0.5	<0.5	<0.5	10	<0.5	<0.5	<0.5	21	<0.5	<0.5	<0.5	49	<0.5	<0.5	<0.5	--	--
Chloroform (THM)	µg/L	17	<0.5	<1	<1	51	<0.5	<0.5	0.72	10	<0.5	<0.5	<1	21	<0.5	<0.5	17.8	49	<0.5	<1	<1	--	--
Di(2-ethylhexyl)phthalate	µg/L	2	<3	<3	<3	55	<3	<3	3.2	9	<3	<3	<3	0	--	--	--	12	<3	<3	<3	4	--
Tetrachloroethene	µg/L	17	<0.5	<0.5	<0.5	130	<0.5	<0.5	0.5	15	<0.5	<0.5	<0.5	21	<0.5	<0.5	<0.5	61	<0.5	<0.5	1	5	--
Total Trihalomethanes	µg/L	4	<0.5	<0.5	<0.5	32	<0.5	<0.5	0.9	1	<0.5	<0.5	<0.5	0	--	--	--	0	--	--	--	80	--

Notes: µg/l = micrograms per liter; Min = minimum value; Max = maximum
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
3. For data sets containing detected values above and below multiple reporting limits, the median was computed by first re-censoring the data to the highest detection limit, then proceeding in accordance with methods outlined on pages 363 to 365 of "*Statistical Methods in Water Resources",* by D.R. Helsel and R.M. Hirsch, 1992.
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

Table B-4. Summary of 2010 Pesticide Data

Constituent		Santa Clara Subbasin - Santa Clara Plain						Santa Clara Subbasin - Coyote Valley			Llagas Subbasin						Maximum Contaminant Levels	
		Shallow Zone			Principal Zone						Shallow Zone			Principal Zone				
	Units	Number of results[1]	Result[2]	RL[3]	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	MCL[4]	SMCL[5]
2,3,7,8-Tcdd (Dioxin)	µg/L	2	ND	<5	51	ND	<5	9	ND	<5	0	NA	--	21	ND	<0.000005	0.00003	--
2,4,5-T	µg/L	0	NA	--	2	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--
2,4,5-Tp (Silvex)	µg/L	2	ND	<1	55	ND	<1	9	ND	<1	0	NA	--	16	ND	<1	50	--
2,4-D	µg/L	2	ND	<10	55	ND	<10	9	ND	<10	0	NA	--	17	ND	<10	70	--
2,4-Db	µg/L	0	NA	--	1	ND	<2	0	NA	--	0	NA	--	0	NA	--	--	--
3,5-Dichlorobenzoic Acid	µg/L	0	NA	--	1	ND	<0.99	0	NA	--	0	NA	--	0	NA	--	--	--
3-Hydroxycarbofuran	µg/L	2	ND	<3	37	ND	<3	2	ND	<3	0	NA	--	0	NA	--	--	--
Alachlor	µg/L	2	ND	<1	58	ND	<1	9	ND	<1	0	NA	--	12	ND	<1	2	--
Aldicarb	µg/L	2	ND	<3	37	ND	<3	2	ND	<3	0	NA	--	0	NA	--	--	--
Aldicarb Sulfone	µg/L	2	ND	<4	37	ND	<4	2	ND	<4	0	NA	--	0	NA	--	--	--
Aldicarb Sulfoxide	µg/L	2	ND	<3	37	ND	<3	2	ND	<3	0	NA	--	0	NA	--	--	--
Aldrin	µg/L	2	ND	<0.075	39	ND	<0.075	2	ND	<0.075	0	NA	--	0	NA	--	--	--
Atrazine	µg/L	2	ND	<0.5	56	ND	<1	9	ND	<0.5	0	NA	--	12	ND	<0.5	1	--
Bentazon	µg/L	2	ND	<2	55	ND	<2	9	ND	<2	0	NA	--	16	ND	<2	18	--
Bromacil	µg/L	2	ND	<10	39	ND	<10	2	ND	<10	0	NA	--	0	NA	--	--	--
Butachlor	µg/L	2	ND	<0.38	39	ND	<0.38	2	ND	<0.38	0	NA	--	0	NA	--	--	--
Captan	µg/L	0	NA	--	1	ND	<0.1	0	NA	--	0	NA	--	0	NA	--	--	--
Carbaryl	µg/L	2	ND	<5	39	ND	<5	2	ND	<5	0	NA	--	0	NA	--	--	--
Carbofuran	µg/L	2	ND	<5	57	ND	<5	9	ND	<5	0	NA	--	15	ND	<5	18	--
Chlordane	µg/L	2	ND	<0.1	55	ND	<0.11	9	ND	<0.1	0	NA	--	15	ND	<0.1	0.1	--
Chlorothalonil	µg/L	0	NA	--	3	ND	<5	0	NA	--	0	NA	--	0	NA	--	--	--
Cis-1,3-Dichloropropene	µg/L	17	ND	<0.5	44	ND	<0.5	10	ND	<0.5	21	ND	<0.5	45	ND	<0.5	0.5	--
Cyanazine	µg/L	0	NA	--	1	ND	<150	0	NA	--	0	NA	--	0	NA	--	--	--
Dalapon	µg/L	2	ND	<10	55	ND	<10	9	ND	<10	0	NA	--	16	ND	<10	200	--
Dcpa (Total Di & Mono Acid Degradates)	µg/L	2	ND	<0.1	35	ND	<2	2	ND	<0.1	0	NA	--	1	ND	<2	--	--
Diazinon	µg/L	2	ND	<0.1	35	ND	<0.25	2	ND	<0.1	0	NA	--	0	NA	--	--	--
Dicamba	µg/L	2	ND	<1.5	38	ND	<1.5	2	ND	<1.5	0	NA	--	1	ND	<1.5	--	--
Dichlorprop	µg/L	0	NA	--	1	ND	<0.99	0	NA	--	0	NA	--	0	NA	--	--	--
Dieldrin	µg/L	2	ND	<0.02	37	ND	<0.02	2	ND	<0.02	0	NA	--	0	NA	--	--	--
Dimethoate	µg/L	2	ND	<0.1	35	ND	<10	2	ND	<0.1	0	NA	--	0	NA	--	--	--
Dinoseb	µg/L	2	ND	<2	55	ND	<2	9	ND	<2	0	NA	--	16	ND	<2	7	--
Diphenamide	µg/L	0	NA	--	1	ND	<100	0	NA	--	0	NA	--	0	NA	--	--	--
Diquat	µg/L	2	ND	<4	55	ND	<4	9	ND	<4	0	NA	--	15	ND	<4	20	--
Disulfoton	µg/L	0	NA	--	1	ND	<100	0	NA	--	0	NA	--	0	NA	--	--	--
Diuron	µg/L	0	NA	--	1	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--

Table B-4. Summary of 2010 Pesticide Data

Constituent		Santa Clara Subbasin - Santa Clara Plain						Santa Clara Subbasin - Coyote Valley			Llagas Subbasin						Maximum Contaminant Levels	
		Shallow Zone			Principal Zone						Shallow Zone			Principal Zone				
	Units	Number of results[1]	Result[2]	RL[3]	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	Number of results	Result	RL	MCL[4]	SMCL[5]
Endothall	µg/L	2	ND	<45	56	ND	<45	9	ND	<45	0	NA	--	12	ND	<45	100	--
Endrin	µg/L	2	ND	<0.1	55	ND	<0.1	9	ND	<0.1	0	NA	--	15	ND	<0.1	2	--
Gamma-BHC (Lindane), Total	µg/L	2	ND	<0.2	57	ND	<0.2	9	ND	<0.2	0	NA	--	15	ND	<0.2	0.2	--
Glyphosate	µg/L	2	ND	<25	55	ND	<25	9	ND	<25	0	NA	--	15	ND	<25	700	--
Heptachlor	µg/L	2	ND	<0.01	55	ND	<0.01	9	ND	<0.01	0	NA	--	15	ND	<0.01	0.01	--
Heptachlor Epoxide	µg/L	2	ND	<0.01	55	ND	<0.01	9	ND	<0.01	0	NA	--	15	ND	<0.01	0.01	--
Hexachlorobenzene	µg/L	2	ND	<0.5	55	ND	<0.5	9	ND	<0.5	0	NA	--	15	ND	<0.5	1	--
Hexachlorocyclopentadiene	µg/L	2	ND	<1	55	ND	<1	9	ND	<1	0	NA	--	15	ND	<1	50	--
Methiocarb	µg/L	2	ND	<0.5	34	ND	<0.5	2	ND	<0.5	0	NA	--	0	NA	--	--	--
Methomyl	µg/L	2	ND	<2	39	ND	<2	2	ND	<2	0	NA	--	0	NA	--	--	--
Methoxychlor	µg/L	2	ND	<10	57	ND	<10	9	ND	<10	0	NA	--	15	ND	<10	30	--
Metolachlor	µg/L	2	ND	<0.05	35	ND	<0.5	2	ND	<0.05	0	NA	--	0	NA	--	--	--
Metribuzin	µg/L	2	ND	<0.05	35	ND	<0.5	2	ND	<0.05	0	NA	--	0	NA	--	--	--
Molinate	µg/L	2	ND	<2	56	ND	<2	9	ND	<2	0	NA	--	12	ND	<2	20	--
Oxamyl	µg/L	2	ND	<20	57	ND	<20	9	ND	<20	0	NA	--	15	ND	<20	50	--
Pentachlorophenol	µg/L	2	ND	<0.2	55	ND	<0.2	9	ND	<0.2	0	NA	--	16	ND	<0.2	1	--
Picloram	µg/L	2	ND	<1	55	ND	<1	9	ND	<1	0	NA	--	16	ND	<1	500	--
Prometryn	µg/L	0	NA	--	1	ND	<2	0	NA	--	0	NA	--	0	NA	--	--	--
Propachlor	µg/L	2	ND	<0.5	38	ND	<0.5	2	ND	<0.5	0	NA	--	0	NA	--	--	--
Propoxur	µg/L	2	ND	<0.5	34	ND	<0.5	2	ND	<0.5	0	NA	--	0	NA	--	--	--
Simazine	µg/L	2	ND	<1	56	ND	<4	9	ND	<1	0	NA	--	12	ND	<1	4	--
Thiobencarb	µg/L	2	ND	<1	56	ND	<1	9	ND	<1	0	NA	--	12	ND	<1	70	1
Toxaphene	µg/L	2	ND	<1	55	ND	<1	9	ND	<1	0	NA	--	15	ND	<1	3	--
Trans-1,3-Dichloropropene	µg/L	17	ND	<0.5	44	ND	<0.5	10	ND	<0.5	21	ND	<0.5	45	ND	<0.5	--	--
Trifluralin	µg/L	0	NA	--	1	ND	<1	0	NA	--	0	NA	--	0	NA	--	--	--

Notes: µg/l = micrograms per liter; Min = minimum value; Max = maximum
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. ND= not detected above laboratory reporting limit. NA = not analyzed. D = detection above reporting limit.
3. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown.
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower threshold is listed first with the upper threshold in parentheses.

Table B-5. Summary of 2010 Inorganic Constituent Data

Constituent	Units	Santa Clara Subbasin - Santa Clara Plain								Santa Clara Subbasin – Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone				Principal Zone								Shallow Zone				Principal Zone					
		Number of results[1]	Min[2]	Median[3]	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	MCL[4]	SMCL[5]
MAJOR AND MINOR IONS																							
Bicarbonate ion (as HCO3-)	mg/L	14	212	352	671	65	150	279	480	18	183	240	430	21	132	270	462	33	130	234	423	--	--
Bromide	mg/L	13	0.06	0.17	3.24	7	0.06	0.12	0.18	9	<0.05	0.14	0.39	21	<0.05	0.1	0.5	20	<0.05	0.12	0.25	--	--
Calcium	mg/L	14	8.3	62.3	160	65	14.8	69	100	18	7.2	43.5	73	21	24.2	58.3	99.1	33	29.1	51.6	92	--	--
Calcium as $CaCO_3$	mg/L	13	20.8	157	400	7	36.9	161	242	9	17.9	124	182	21	60.6	146	248	20	72.7	133	230	--	--
Chloride	mg/L	14	25	53.8	1010	65	17	46	120	18	13	44.5	154	21	8	44	183	33	16	50	109	--	250 (500)
Carbon Dioxide	mg/L	1	13	13	13	56	3.5	11.5	450	5	4.6	4.9	7.1	0	--	--	--	0	--	--	--	--	--
Cyanide	µg/L	0	--	--	--	54	<5	<100	<100	7	<5	<100	<100	0	--	--	--	16	<100	<100	<100	150	--
Fluoride	mg/L	14	<0.05	0.135	0.31	79	0.075	0.13	0.27	18	0.08	0.11	0.19	21	<0.05	0.11	0.2	36	<0.05	0.14	0.32	2	--
Magnesium	mg/L	14	18.6	38.4	141	65	8.5	28.1	77	18	20	35.5	69	21	17.2	43.4	71.1	33	11.4	30.3	59.4	--	--
Perchlorate	µg/L	13	<4	<4	<4	65	<4	<4	<4	17	<4	<4	<4	21	<4	<4	4.31	149	<0.8	<4	10	6	--
Potassium	mg/L	14	<0.5	1.25	5.2	64	<1	1.3	3.7	18	<1	1.2	1.8	21	<0.5	1	1.8	32	<1	1.4	1.9	--	--
Silica	mg/L	13	5.4	25.2	35.4	7	25	29.9	31.9	9	19.7	24.8	39.4	21	15.6	29.3	60.1	20	24.6	28.6	49.6	--	--
Sodium	mg/L	14	24.7	41.1	303	65	18	30	170	18	18.3	26.2	122	21	11	27.7	98.5	33	15.7	26	109	--	--
SAR (adjusted)	--	14	0.68	1.04	4.95	64	0.56	0.88	6.35	17	0.57	0.77	3.43	21	0.38	0.77	2.51	33	0.47	0.85	3.83	--	--
Sulfate	mg/L	14	<0.5	55	198	65	4.3	43	81.2	18	1.5	36	57.7	21	14.2	51.2	126	42	3.5	37.5	63.2	--	250 (500)
Total Dissolved Solids	mg/L	14	306	467	1,850	65	270	400	618	18	270	340	614	21	144	484	739	33	288	340	746	--	500 (1,000)
NUTRIENTS																							
Nitrate (as NO_3)	mg/L	14	<0.05	6.8	27.4	339	<2	15	48.5	41	<0.05	9.3	51.3	21	<0.05	43.9	199	221	<0.05	23	148	45	--
Nitrate + nitrite (as N)	mg/L	1	2.3	2.3	2.3	63	<0.4	2.8	7.2	9	0.47	0.71	5.6	0	--	--	--	15	<0.4	3.8	28.4	10	--
Nitrite (as N)	mg/L	1	<0.4	<0.4	<0.4	68	<0.05	<0.4	0.94	20	<0.4	<0.4	<0.4	0	--	--	--	25	<0.4	<0.4	<0.4	1	--
Phosphate	mg/L	13	<0.05	0.1	0.86	7	<0.05	0.06	2.75	9	<0.05	<0.05	0.38	21	<0.05	0.07	0.24	20	<0.05	0.05	0.49	--	--
TRACE ELEMENTS																							
Aluminum	µg/L	14	<20	<50	100	79	<20	<50	2,600	18	<20	<50	1,900	21	<20	<20	56	37	<20	<50	130	1,000	200
Antimony	µg/L	1	<6	<6	<6	66	<2	<6	<6	9	<6	<6	<6	0	--	--	--	16	<6	<6	<6	6	--
Arsenic	µg/L	1	<2	<2	<2	65	<2	<2	2.3	9	<2	<2	<2	0	--	--	--	17	<2	<2	<2	10	--
Asbestos	MFL	0	--	--	--	1	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2	0	--	--	--	9	0.19	<0.2	2	7	--
Barium	µg/L	14	33	93.9	560	72	58	110	300	18	75.4	<100	250	21	<20	110	280	36	20	<100	430	1,000	--
Beryllium	µg/L	1	<1	<1	<1	66	<1	<1	<1	9	<1	<1	<1	0	--	--	--	16	<1	<1	<1	4	--
Boron	µg/L	13	80	162	616	7	72.5	142	423	9	<50	102	151	21	<50	120	339	20	<50	94	220	--	--
Cadmium	µg/L	1	<1	<1	<1	65	<1	<1	<1	9	<1	<1	<1	0	--	--	--	16	<1	<1	<1	5	--
Chromium VI (hexavalent)	µg/L	0	--	--	--	21	0.27	1.3	2.5	0	--	--	--	0	--	--	--	0	--	--	--	--	--
Chromium (total)	µg/L	1	<10	<10	<10	69	5.23	<10	11.6	9	<10	<10	15	0	--	--	--	16	<10	<10	<10	50	--
Copper	µg/L	1	<50	<50	<50	64	<10	<50	93	9	<50	<50	<50	0	--	--	--	13	<50	<50	150	1,300	1,000
Iron	µg/L	14	<20	<100	1,300	97	<20	<100	3,200	18	<20	<100	5,600	21	<20	<20	230	34	<20	<100	270	--	300

Table B-5. Summary of 2010 Inorganic Constituent Data

Constituent	Units	Santa Clara Subbasin -Santa Clara Plain								Santa Clara Subbasin – Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone				Principal Zone								Shallow Zone				Principal Zone					
		Number of results[1]	Min[2]	Median[3]	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	MCL[4]	SMCL[5]
Lead	µg/L	1	<5	<5	<5	63	<1	<5	7	8	<5	<5	9.4	0	--	--	--	15	<5	<5	<5	15	--
Manganese	µg/L	1	<20	<20	<20	71	4.7	<20	330	9	<20	<20	140	0	--	--	--	13	<20	<20	110	--	50
Mercury	µg/L	1	<1	<1	<1	65	<0.2	0.38	0.5	9	<1	<1	<1	0	--	--	--	15	<1	<1	<1	2	--
Nickel	µg/L	1	<10	<10	<10	66	<3	<10	18	9	<10	<10	30	0	--	--	--	16	<10	<10	<10	100	--
Selenium	µg/L	1	<5	<5	<5	65	<2	<5	5.5	9	<5	<5	<5	0	--	--	--	16	2.1	2.45	2.8	50	--
Silver	µg/L	1	<10	<10	<10	58	<10	<10	<10	9	<10	<10	<10	0	--	--	--	13	<10	<10	<10	--	100
Thallium	µg/L	1	<1	<1	<1	66	<1	<1	<1	9	<1	<1	<1	0	--	--	--	16	<1	<1	<1	2	--
Zinc	µg/L	14	<10	<50	56	65	<10	<50	62	18	<10	<50	<50	21	<10	<10	70	33	<10	<50	130	--	5000

Notes: mg/l = milligrams per liter; µg/l = micrograms per liter; MFL = Million Fibers per Liter; Min = minimum value; Max = maximum value
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
3. For data sets containing detected values above and below multiple reporting limits, the median was computed by first re-censoring the data to the highest detection limit, then proceeding in accordance with methods outlined on pages 363 to 365 of "*Statistical Methods in Water Resources",* by D.R. Helsel and R.M. Hirsch, 1992
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard. Lead and Copper Action Rule values shown for those constituents.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

Table B-6. Summary of 2010 Radioactive Constituent Data

Constituent		Santa Clara Subbasin - Santa Clara Plain								Santa Clara Subbasin – Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone				Principal Zone								Shallow Zone				Principal Zone					
	Units	Number of results[1]	Min[2]	Median[3]	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	Number of results	Min	Median	Max	MCL[2]	SMCL[3]
Gross Alpha	pci/L	0	--	--	--	37	0.54	<3	7.08	7	0.77	<3	5.69	0	--	--	--	13	0.8	<3	3.52	15	--
Gross Beta	mrem/yr	0	--	--	--	12	<4	<4	<4	0	--	--	--	0	--	--	--	0	--	--	--	4	--
Radium 226	pci/L	0	--	--	--	3	<1	<1	<1	0	--	--	--	0	--	--	--	0	--	--	--	5	--
Radium 228	pci/L	0	--	--	--	11	0.48	<1	1.93	4	1.08	1.3	1.77	0	--	--	--	11	0.77	1.07	1.99	5	--
Uranium	pci/L	0	--	--	--	3	0.311	0.331	0.343	0	--	--	--	0	--	--	--	0	--	--	--	20	--
Gross Alpha Counting Error	pci/L	0	--	--	--	28	0.65	1.49	3.73	7	0.11	0.62	2.49	0	--	--	--	13	0.16	1.21	1.99	--	--
Gross Beta Counting Error	pci/L	0	--	--	--	6	0.71	0.89	1.2	0	--	--	--	0	--	--	--	0	--	--	--	--	--
Radium 226 Counting Error	pci/L	0	--	--	--	3	0.21	0.39	0.394	0	--	--	--	0	--	--	--	0	--	--	--	--	--
Radium 228 Counting Error	pci/L	0	--	--	--	6	0.21	0.36	0.5	4	0.3	0.32	0.48	0	--	--	--	11	0.23	0.44	0.6	--	--
Gross Alpha MDA95	pci/L	0	--	--	--	27	0.02	0.98	3	4	0.04	0.06	0.37	0	--	--	--	11	0.04	0.08	0.37	--	--
Radium 228 MDA95	pci/L	0	--	--	--	6	0.21	0.78	1.39	4	0.38	0.73	0.73	0	--	--	--	11	0.4	0.79	0.99	--	--
Gross Beta MDA95	pci/L	0	--	--	--	6	3	3	3	0	--	--	--	0	--	--	--	0	--	--	--	--	--

Notes: pCi/l = picocuries per liter; mrem/yr = millirem per year; Min = minimum value; Max = maximum value
Shallow Zone is represented by wells with total depth less than 150 feet. Principal Zone is represented by wells with total depth greater than 150 feet.

1. Number of results in 2010 for each parameter. Some parameters may have been analyzed more than once at a particular well.
2. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
3. For data sets containing detected values above and below multiple reporting limits, the median was computed by first re-censoring the data to the highest detection limit, then proceeding in accordance with methods outlined on pages 363 to 365 of "*Statistical Methods in Water Resources",* by D.R. Helsel and R.M. Hirsch, 1992
4. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard. Lead and Copper Action Rule values shown for those constituents.
5. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per California Department of Public Health or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

Appendix C. Mann-Kendall Results for Wells with Statistically Significant Downward Concentration Trend, 2001 - 2010.

Masked Well ID	Constituent	n	S	z	*p* value	τ	Magnitude of Trend
Santa Clara Subbasin - Santa Clara Plain							
SC-18	Chloride	12	-32	-2.126	0.034	-0.48	-140
SC-24	Chloride	9	-21	-2.097	0.036	-0.58	-2
SC-29	Chloride	8	-17	-1.995	0.046	-0.61	-1
SC-30	Chloride	5	-10	-2.205	0.028	-1	-8
SC-31	Chloride	9	-22	-2.247	0.025	-0.61	-1
SC-32	Chloride	10	-38	-3.3236	0.001	-0.84	-1
SC-35	Chloride	8	-22	-2.598	0.009	-0.79	-7
SC-44	Chloride	11	-39	-2.958	0.003	-0.71	-5
SC-46	Chloride	12	-46	-3.1	0.002	-0.7	-2
SC-51	Chloride	9	-21	-2.097	0.036	-0.58	-1
SC-101	Nitrate	10	-24	-2.065	0.039	-0.53	-0.5
SC-139	Nitrate	5	-10	-2.205	0.028	-1	-1.3
SC-142	Nitrate	30	-143	-2.536	0.011	-0.33	-0.3
SC-169	Nitrate	18	-60	-2.275	0.023	-0.39	-0.6
SC-222	Nitrate	11	-31	-2.335	0.020	-0.56	-1.0
SC-225	Nitrate	21	-68	-2.023	0.043	-0.32	-0.4
SC-236	Nitrate	7	-16	-2.279	0.023	-0.76	-1.5
SC-237	Nitrate	19	-63	-2.239	0.025	-0.37	-0.7
SC-238	Nitrate	7	-18	-2.666	0.008	-0.86	-0.6
SC-244	Nitrate	5	-10	-2.205	0.028	-1	-1.6
SC-246	Nitrate	10	-32	-2.838	0.005	-0.71	-0.8
SC-250	Nitrate	9	-32	-3.23	0.001	-0.89	-1.0
SC-255	Nitrate	8	-26	-3.093	0.002	-0.93	-0.3
SC-256	Nitrate	8	-22	-2.598	0.009	-0.79	-0.7
SC-26	Nitrate	6	-12	-2.104	0.035	-0.8	-0.4
SC-50	Nitrate	37	-238	-3.103	0.002	-0.36	-0.4
SC-51	Nitrate	10	-222	-2.237	0.025	-0.23	-0.4
SC-53	Nitrate	17	-77	-3.14	0.002	-0.57	-1.1
SC-70	Nitrate	33	-170	-2.625	0.009	-0.32	-1.3
SC-165	TDS	6	-13	-2.254	0.024	-0.87	-14
SC-44	TDS	7	-19	-2.703	0.007	-0.9	-56
Santa Clara Subbasin - Coyote Valley							
C-15	Nitrate	20	-85	-2.548	0.011	-0.4	-0.8
C-18	Nitrate	10	-740	-3.504	0.001	-0.27	-0.3
C-19	Nitrate	10	-38	-3.323	0.001	-0.84	-0.3
C-21	Nitrate	10	-39	-3.464	0.005	-0.87	-0.9
C-25	Nitrate	5	-14	-2.487	0.013	-0.93	-1.4
C-26	Nitrate	12	-30	-1.989	0.047	-0.45	-1.3
Llagas Subbasin							
L-10	Nitrate	10	-29	-2.525	0.012	-0.64	-0.5
L-11	Nitrate	9	-20	-2.524	0.012	-0.71	-0.4
L-15	Nitrate	11	-30	-2.283	0.022	-0.55	-0.3
L-21	Nitrate	10	-37	-3.246	0.001	-0.82	-1.2
L-22	Nitrate	10	-31	-2.909	0.004	-0.69	-0.6
L-30	Nitrate	8	-25	-2.992	0.003	-0.89	-1.0
L-33	Nitrate	10	-26	-2.263	0.024	-0.58	-0.9
L-34	Nitrate	15	-53	-2.586	0.010	-0.5	-2.1
L-4	Nitrate	7	-15	-2.103	0.036	-0.71	-1.4
L-43	Nitrate	19	-67	-2.416	0.016	-0.39	-0.4
L-5	Nitrate	11	-28	-2.108	0.035	-0.51	-0.4

Appendix C. Mann-Kendall Results for Wells with Statistically Significant Downward Concentration Trend, 2001 - 2010. (Continued)

Masked Well ID	Constituent	n	S	z	*p* value	τ	Magnitude of Trend
Llagas Subbasin (continued)							
L-56	Nitrate	10	-25	-2.147	0.032	-0.56	-6.5
L-57	Nitrate	10	-23	-1.968	0.049	-0.51	-1.3
L-61	Nitrate	12	-31	-2.062	0.039	-0.47	-0.6
L-7	Nitrate	10	-32	-2.784	0.005	-0.71	-1.1
L-8	Nitrate	7	-588	-5.594	0.000	-0.57	-1.5
L-81	Nitrate	9	-32	-3.232	0.001	-0.89	-0.9
L-96	Nitrate	38	-249	-3.05	0.002	-0.34	-0.3
L-98	Nitrate	8	-26	-3.093	0.002	-0.93	-1.0

Notes: n = number of data records; S = Mann-Kendall test statistic, z = Mann-Kendall statistic (S) converted to test statistic that is approximated by a normal distribution; *p* value = probability of getting the observed value of τ, or one more extreme, when the null hypothesis is true; τ = Kendall's tau (correlation coefficient); magnitude of trend = median slope of all pair-wise slopes.

Appendix D. Mann-Kendall Results for Wells with Statistically Significant Upward Concentration Trend, 2001 - 2010.

Masked Well ID	Constituent	n	S	z	*p* value	τ	Magnitude of Trend
Santa Clara Subbasin - Santa Clara Plain							
SC-22	Chloride	10	45	3.9	0.000	1	57
SC-28	Chloride	11	29	2.18	0.029	0.53	11
SC-262	Chloride	5	10	2.205	0.027	1	17
SC-104	Nitrate	26	114	2.494	0.013	0.35	0.9
SC-107	Nitrate	5	10	2.205	0.028	1	1.8
SC-12	Nitrate	9	23	2.341	0.019	0.64	0.6
SC-213	Nitrate	21	68	2.028	0.043	0.32	0.5
SC-214	Nitrate	38	213	2.571	0.010	0.29	0.4
SC-230	Nitrate	11	27	2.036	0.042	0.49	0.4
SC-233	Nitrate	9	21	2.097	0.036	0.58	0.07
SC-52	Nitrate	21	78	2.173	0.030	0.34	0.9
SC-54	Nitrate	20	64	2.051	0.040	0.34	0.4
SC-55	Nitrate	9	24	2.065	0.039	0.53	0.8
SC-56	Nitrate	23	93	2.284	0.022	0.34	0.8
SC-63	Nitrate	10	34	2.996	0.003	0.76	0.9
SC-81	Nitrate	5	10	2.205	0.028	1	0.5
SC-91	Nitrate	20	79	2.542	0.011	0.42	0.7
SC-96	Nitrate	9	20	2.033	0.042	0.56	0.3
SC-97	Nitrate	10	29	2.504	0.012	0.64	0.6
SC-22	TDS	9	34	3.44	0.006	0.94	112
SC-23	TDS	8	22	2.598	0.009	0.79	10
SC-239	TDS	6	15	2.6	0.009	1	10
SC-28	TDS	8	20	2.351	0.019	0.71	42
Santa Clara Subbasin - Coyote Valley							
C-10	Nitrate	9	28	2.815	0.005	0.78	1.9
C-14	Nitrate	20	90	2.734	0.006	0.43	0.7
C-17	Nitrate	10	29	2.552	0.011	0.64	0.5
C-6	Nitrate	8	23	2.306	0.021	0.64	2.1
C-6	TDS	7	19	2.703	0.007	0.9	18
Llagas Subbasin							
L-116	Chloride	12	40	2.687	0.007	0.61	4
L-86	Chloride	10	34	2.963	0.003	0.76	2
L-24	Nitrate	37	218	2.845	0.004	0.33	1.2
L-28	Nitrate	12	51	3.056	0.002	0.65	10.0
L-29	Nitrate	9	34	2.963	0.003	0.76	2.3
L-59	Nitrate	10	23	2.04	0.041	0.51	0.5
L-80	Nitrate	9	27	2.798	0.005	0.75	0.7
L-86	Nitrate	15	68	3.32	0.001	0.65	6.6
L-87	Nitrate	10	28	2.47	0.013	0.62	0.5
L-9	Nitrate	10	22	1.901	0.057	0.49	0.5
L-86	TDS	10	25	2.164	0.031	0.56	17

Notes: n = number of data records; S = Mann-Kendall test statistic, z = Mann-Kendall statistic (S) converted to test statistic that is approximated by a normal distribution; *p* value = probability of getting the observed value of τ, or one more extreme, when the null hypothesis is true; τ = Kendall's tau (correlation coefficient); magnitude of trend = median slope of all pair-wise slopes.

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2001 - 2010.

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain						
SC-1	Chloride	11	-12	-0.86	0.402	-0.22
SC-10	Chloride	4	4	1.02	0.334	0.67
SC-103	Chloride	5	8	1.71	0.084	0.80
SC-104	Chloride	4	6	1.70	0.084	1.00
SC-106	Chloride	7	-6	-0.75	0.472	-0.29
SC-107	Chloride	4	4	1.02	0.334	0.67
SC-108	Chloride	5	0	0.00	1.000	0.00
SC-109	Chloride	6	2	0.19	0.860	0.13
SC-11	Chloride	6	5	0.75	0.470	0.33
SC-110	Chloride	5	0	0.00	1.000	0.00
SC-121	Chloride	4	2	0.34	0.750	0.33
SC-124	Chloride	5	-2	-0.24	0.816	-0.20
SC-125	Chloride	4	4	1.02	0.334	0.67
SC-127	Chloride	5	-4	-0.73	0.484	-0.40
SC-130	Chloride	5	-4	-0.73	0.484	-0.40
SC-131	Chloride	4	3	0.68	0.542	0.50
SC-132	Chloride	5	7	1.47	0.158	0.70
SC-133	Chloride	4	-2	-0.34	0.750	-0.33
SC-134	Chloride	4	5	1.36	0.208	0.83
SC-137	Chloride	4	4	1.02	0.334	0.67
SC-140	Chloride	4	4	1.02	0.334	0.67
SC-141	Chloride	4	-2	-0.34	0.750	-0.33
SC-142	Chloride	7	2	0.15	0.886	0.10
SC-143	Chloride	4	0	0.00	1.000	0.00
SC-147	Chloride	4	2	0.34	0.750	0.33
SC-148	Chloride	4	5	1.36	0.208	0.83
SC-149	Chloride	4	6	1.70	0.084	1.00
SC-15	Chloride	9	-10	-0.94	0.358	-0.28
SC-150	Chloride	4	2	0.34	0.750	0.33
SC-151	Chloride	4	2	0.34	0.750	0.33
SC-157	Chloride	4	-4	-1.02	0.334	-0.67
SC-159	Chloride	4	2	0.34	0.750	0.33
SC-164	Chloride	4	4	1.02	0.334	0.67
SC-165	Chloride	5	-6	-1.22	0.234	-0.60
SC-166	Chloride	5	-4	-0.73	0.484	-0.40
SC-167	Chloride	7	7	0.90	0.382	0.33
SC-17	Chloride	4	-1	0.00	1.000	-0.17
SC-170	Chloride	4	4	1.02	0.334	0.67
SC-176	Chloride	4	-6	-1.70	0.084	-1.00
SC-177	Chloride	4	6	1.70	0.084	1.00
SC-182	Chloride	4	-6	-1.70	0.084	-1.00
SC-183	Chloride	4	-4	-1.02	0.334	-0.67
SC-185	Chloride	4	3	0.68	0.542	0.50
SC-19	Chloride	8	5	0.49	0.634	0.18
SC-190	Chloride	6	-5	-0.75	0.470	-0.33
SC-191	Chloride	4	-1	0.00	1.000	-0.17
SC-193	Chloride	4	-4	-1.02	0.334	-0.67
SC-197	Chloride	4	4	1.02	0.334	0.67
SC-198	Chloride	4	-3	-0.68	0.542	-0.50

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-199	Chloride	5	-3	-0.49	0.650	-0.30
SC-20	Chloride	7	6	0.75	0.211	0.29
SC-201	Chloride	6	5	0.75	0.470	0.33
SC-202	Chloride	4	-4	-1.02	0.334	-0.67
SC-203	Chloride	4	0	0.00	1.000	0.00
SC-205	Chloride	4	4	1.02	0.334	0.67
SC-206	Chloride	6	5	0.75	0.470	0.33
SC-207	Chloride	5	-4	-0.73	0.484	-0.40
SC-208	Chloride	6	-9	-1.50	0.136	-0.60
SC-209	Chloride	4	-4	-1.02	0.334	-0.67
SC-21	Chloride	7	3	0.30	0.772	0.14
SC-210	Chloride	6	7	1.13	0.272	0.47
SC-211	Chloride	5	0	0.00	1.000	0.00
SC-212	Chloride	6	9	1.50	0.136	0.60
SC-219	Chloride	4	5	1.36	0.208	0.83
SC-225	Chloride	4	-4	-1.02	0.334	-0.67
SC-226	Chloride	7	-9	-1.20	0.238	-0.43
SC-228	Chloride	4	-1	0.00	1.000	-0.17
SC-23	Chloride	12	-14	-0.89	0.380	-0.21
SC-232	Chloride	7	5	0.60	0.562	0.24
SC-235	Chloride	4	6	1.70	0.084	1.00
SC-239	Chloride	6	2	0.19	0.860	0.13
SC-244	Chloride	5	4	0.73	0.484	0.40
SC-245	Chloride	4	4	1.02	0.334	0.67
SC-246	Chloride	5	4	0.73	0.484	0.40
SC-247	Chloride	4	6	1.70	0.084	1.00
SC-249	Chloride	5	5	0.98	0.358	0.50
SC-25	Chloride	10	6	0.45	0.664	0.13
SC-250	Chloride	4	3	0.68	0.542	0.50
SC-252	Chloride	4	4	1.02	0.334	0.67
SC-254	Chloride	8	16	1.86	0.062	0.57
SC-257	Chloride	4	6	1.70	0.084	1.00
SC-258	Chloride	4	6	1.70	0.084	1.00
SC-259	Chloride	4	6	1.70	0.084	1.00
SC-26	Chloride	5	1	0.00	1.000	0.10
SC-260	Chloride	4	6	1.70	0.084	1.00
SC-27	Chloride	8	12	1.36	0.178	0.43
SC-3	Chloride	4	-4	-1.02	0.334	-0.67
SC-33	Chloride	5	4	0.73	0.484	0.40
SC-34	Chloride	6	5	0.75	0.470	0.33
SC-36	Chloride	8	-12	-1.36	0.178	-0.43
SC-37	Chloride	5	-3	-0.49	0.650	-0.30
SC-38	Chloride	4	0	0.00	1.000	0.00
SC-39	Chloride	6	-7	-1.13	0.272	-0.47
SC-4	Chloride	4	-4	-1.02	0.334	-0.67
SC-40	Chloride	6	-8	-1.32	0.204	-0.53
SC-41	Chloride	5	-1	0.00	1.000	-0.10
SC-45	Chloride	5	7	1.47	0.158	0.70
SC-47	Chloride	12	-18	-1.17	0.250	-0.27
SC-48	Chloride	7	0	0.00	1.000	0.00
SC-5	Chloride	5	-4	-0.73	0.484	-0.40

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-54	Chloride	4	0	0.00	1.000	0.00
SC-55	Chloride	12	28	1.85	0.062	0.42
SC-56	Chloride	5	-7	-1.47	0.158	-0.70
SC-57	Chloride	4	-6	-1.70	0.084	-1.00
SC-6	Chloride	6	6	0.94	0.370	0.40
SC-60	Chloride	4	6	1.70	0.084	1.00
SC-61	Chloride	7	-3	-0.30	0.772	-0.14
SC-62	Chloride	5	6	1.22	0.234	0.60
SC-63	Chloride	8	2	0.12	0.904	0.07
SC-66	Chloride	11	-17	-1.25	0.218	-0.31
SC-75	Chloride	8	4	0.37	0.720	0.14
SC-78	Chloride	4	2	0.34	0.750	0.33
SC-79	Chloride	4	4	1.02	0.334	0.67
SC-80	Chloride	4	6	1.70	0.084	1.00
SC-82	Chloride	4	-2	-0.34	0.750	-0.33
SC-83	Chloride	6	-1	0.00	1.000	-0.07
SC-85	Chloride	4	4	1.02	0.334	0.67
SC-86	Chloride	6	-7	-1.13	0.272	-0.47
SC-87	Chloride	6	-4	-0.56	0.594	-0.27
SC-88	Chloride	5	-3	-0.49	0.650	-0.30
SC-89	Chloride	5	4	0.73	0.484	0.40
SC-9	Chloride	4	-4	-1.02	0.334	-0.67
SC-90	Chloride	8	-7	-0.74	0.472	-0.25
SC-91	Chloride	6	-1	0.00	1.000	-0.07
SC-93	Chloride	4	-2	-0.34	0.750	-0.33
SC-98	Chloride	4	6	1.70	0.084	1.00
SC-1	Nitrate	10	-1	0.00	1.000	-0.02
SC-10	Nitrate	10	-6	-0.45	0.664	-0.13
SC-100	Nitrate	14	9	0.44	0.668	0.10
SC-102	Nitrate	30	-89	-1.57	0.118	-0.20
SC-103	Nitrate	11	3	0.16	0.880	0.05
SC-105	Nitrate	33	91	1.39	0.164	0.17
SC-106	Nitrate	7	-3	-0.30	0.772	-0.14
SC-108	Nitrate	4	2	0.34	0.750	0.33
SC-109	Nitrate	5	-4	-0.73	0.484	-0.40
SC-11	Nitrate	10	7	0.54	0.600	0.16
SC-110	Nitrate	4	2	0.34	0.750	0.33
SC-111	Nitrate	6	3	0.38	0.720	0.20
SC-112	Nitrate	5	-8	-1.71	0.084	-0.80
SC-113	Nitrate	8	-2	-0.12	0.904	-0.07
SC-114	Nitrate	9	-19	-1.88	0.060	-0.53
SC-115	Nitrate	6	1	0.00	1.000	0.07
SC-116	Nitrate	6	3	0.38	0.720	0.20
SC-117	Nitrate	10	21	1.79	0.072	0.47
SC-118	Nitrate	9	18	1.77	0.076	0.50
SC-119	Nitrate	8	7	0.74	0.472	0.25
SC-120	Nitrate	8	15	1.73	0.084	0.54
SC-121	Nitrate	10	19	1.61	0.108	0.42
SC-122	Nitrate	9	6	0.52	0.612	0.17
SC-123	Nitrate	7	9	1.20	0.238	0.43
SC-124	Nitrate	5	2	0.24	0.816	0.20

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-126	Nitrate	9	7	0.63	0.544	0.19
SC-127	Nitrate	11	-3	-0.16	0.880	-0.05
SC-128	Nitrate	9	8	0.73	0.476	0.22
SC-129	Nitrate	10	-12	-0.98	0.336	-0.27
SC-13	Nitrate	4	-1	0.00	1.000	-0.17
SC-130	Nitrate	10	1	0.00	1.000	0.02
SC-131	Nitrate	7	3	0.30	0.772	0.14
SC-132	Nitrate	7	14	1.95	0.050	0.67
SC-133	Nitrate	5	-7	-1.47	0.158	-0.70
SC-134	Nitrate	7	-7	-0.90	0.382	-0.33
SC-135	Nitrate	5	-9	-1.96	0.050	-0.90
SC-136	Nitrate	7	9	1.20	0.238	0.43
SC-137	Nitrate	7	11	1.50	0.136	0.52
SC-138	Nitrate	6	11	1.88	0.056	0.73
SC-14	Nitrate	4	2	0.34	0.750	0.33
SC-140	Nitrate	4	0	0.00	1.000	0.00
SC-141	Nitrate	36	29	0.38	0.704	0.05
SC-143	Nitrate	10	13	1.07	0.292	0.29
SC-144	Nitrate	4	-1	0.00	1.000	-0.17
SC-145	Nitrate	11	13	0.93	0.358	0.24
SC-146	Nitrate	4	-1	0.00	1.000	-0.17
SC-147	Nitrate	9	0	0.00	1.000	0.00
SC-148	Nitrate	6	9	1.50	0.136	0.60
SC-149	Nitrate	8	9	0.99	0.336	0.32
SC-15	Nitrate	14	3	0.11	0.914	0.03
SC-150	Nitrate	5	-6	-1.22	0.234	-0.60
SC-151	Nitrate	7	-1	0.00	1.000	-0.05
SC-152	Nitrate	9	-5	-0.42	0.686	-0.14
SC-153	Nitrate	9	13	1.25	0.220	0.36
SC-154	Nitrate	5	6	1.22	0.234	0.60
SC-155	Nitrate	8	15	1.73	0.084	0.54
SC-156	Nitrate	5	0	0.00	1.000	0.00
SC-157	Nitrate	8	-6	-0.62	0.548	-0.21
SC-158	Nitrate	8	13	1.48	0.142	0.46
SC-159	Nitrate	11	26	1.95	0.050	0.47
SC-16	Nitrate	33	16	0.23	0.818	0.03
SC-160	Nitrate	9	0	0.00	1.000	0.00
SC-161	Nitrate	9	14	1.36	0.180	0.39
SC-162	Nitrate	6	1	0.00	1.000	0.07
SC-163	Nitrate	6	-2	-0.19	0.860	-0.13
SC-165	Nitrate	5	-4	-0.73	0.484	-0.40
SC-166	Nitrate	4	-6	-1.70	0.084	-1.00
SC-167	Nitrate	7	5	0.60	0.562	0.24
SC-168	Nitrate	10	-12	-0.98	0.336	-0.27
SC-17	Nitrate	9	-5	-0.42	0.686	-0.14
SC-170	Nitrate	18	-7	-0.23	0.822	-0.05
SC-171	Nitrate	7	7	0.90	0.382	0.33
SC-172	Nitrate	5	-5	-0.98	0.358	-0.50
SC-173	Nitrate	30	-89	-1.57	0.118	-0.20
SC-174	Nitrate	11	-23	-1.71	0.086	-0.42
SC-175	Nitrate	10	-6	-0.45	0.664	-0.13

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-176	Nitrate	9	2	0.10	0.920	0.06
SC-177	Nitrate	20	-40	-1.27	0.208	-0.21
SC-178	Nitrate	8	0	0.00	1.000	0.00
SC-179	Nitrate	8	-4	-0.37	0.720	-0.14
SC-18	Nitrate	8	0	0.00	1.000	0.00
SC-180	Nitrate	8	4	0.37	0.720	0.14
SC-181	Nitrate	8	-4	-0.37	0.720	-0.14
SC-182	Nitrate	11	-5	-0.31	0.762	-0.09
SC-183	Nitrate	8	-6	-0.62	0.548	-0.21
SC-184	Nitrate	9	-4	-0.31	0.762	-0.11
SC-185	Nitrate	8	-10	-1.11	0.276	-0.36
SC-186	Nitrate	12	-13	-0.82	0.420	-0.20
SC-187	Nitrate	6	-6	-0.94	0.370	-0.40
SC-188	Nitrate	7	-2	-0.15	0.886	-0.10
SC-189	Nitrate	5	-9	-1.96	0.050	-0.90
SC-190	Nitrate	12	-17	-1.10	0.280	-0.26
SC-191	Nitrate	10	-5	-0.36	0.728	-0.11
SC-192	Nitrate	4	0	0.00	1.000	0.00
SC-193	Nitrate	9	16	1.56	0.120	0.44
SC-194	Nitrate	10	7	0.54	0.600	0.16
SC-195	Nitrate	4	2	0.34	0.750	0.33
SC-196	Nitrate	4	5	1.36	0.208	0.83
SC-197	Nitrate	4	0	0.00	1.000	0.00
SC-198	Nitrate	4	4	1.02	0.334	0.67
SC-199	Nitrate	5	-1	0.00	1.000	-0.10
SC-2	Nitrate	6	-5	-0.75	0.470	-0.33
SC-200	Nitrate	9	11	1.04	0.308	0.31
SC-201	Nitrate	13	-10	-0.55	0.590	-0.13
SC-202	Nitrate	10	7	0.54	0.600	0.16
SC-203	Nitrate	9	9	0.83	0.416	0.25
SC-204	Nitrate	9	-1	0.00	1.000	-0.03
SC-206	Nitrate	5	-4	-0.73	0.484	-0.40
SC-207	Nitrate	4	-3	-0.68	0.542	-0.50
SC-208	Nitrate	5	1	0.00	1.000	0.10
SC-210	Nitrate	6	0	0.00	1.154	0.00
SC-211	Nitrate	5	-4	-0.73	0.484	-0.40
SC-212	Nitrate	6	9	1.50	0.136	0.60
SC-215	Nitrate	10	21	1.79	0.072	0.47
SC-216	Nitrate	34	-14	-0.19	0.848	-0.02
SC-217	Nitrate	32	24	0.37	0.712	0.05
SC-218	Nitrate	39	135	1.62	0.106	0.18
SC-219	Nitrate	20	-2	-0.03	0.974	-0.01
SC-22	Nitrate	9	0	0.00	1.000	0.00
SC-220	Nitrate	19	10	0.31	0.756	0.06
SC-221	Nitrate	5	-8	-1.71	0.084	-0.80
SC-223	Nitrate	17	34	1.36	0.176	0.25
SC-224	Nitrate	10	12	0.98	0.336	0.27
SC-226	Nitrate	24	-67	-1.64	0.102	-0.24
SC-227	Nitrate	25	-19	-0.42	0.676	-0.06
SC-228	Nitrate	29	78	1.44	0.150	0.19
SC-229	Nitrate	8	-3	-0.25	0.812	-0.11

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-23	Nitrate	8	0	0.00	1.000	0.00
SC-231	Nitrate	8	-15	-1.73	0.084	-0.54
SC-232	Nitrate	7	3	0.30	0.772	0.14
SC-234	Nitrate	9	-3	-0.21	0.840	-0.08
SC-235	Nitrate	4	4	1.02	0.334	0.67
SC-239	Nitrate	6	5	0.75	0.470	0.33
SC-240	Nitrate	8	-12	-1.36	0.178	-0.43
SC-241	Nitrate	8	-10	-1.11	0.276	-0.36
SC-242	Nitrate	8	-14	-1.61	0.108	-0.50
SC-243	Nitrate	8	9	0.99	0.336	0.32
SC-245	Nitrate	9	-13	-1.25	0.220	-0.36
SC-247	Nitrate	9	-5	-0.42	0.686	-0.14
SC-248	Nitrate	6	-1	0.00	1.000	-0.07
SC-249	Nitrate	10	-13	-1.07	0.292	-0.29
SC-251	Nitrate	4	0	0.00	1.000	0.00
SC-252	Nitrate	8	-9	-0.99	0.336	-0.32
SC-253	Nitrate	9	-17	-1.67	0.098	-0.47
SC-254	Nitrate	8	0	0.00	1.000	0.00
SC-257	Nitrate	9	-10	-0.94	0.358	-0.28
SC-258	Nitrate	8	-9	-0.99	0.336	-0.32
SC-259	Nitrate	8	-13	-1.48	0.142	-0.46
SC-260	Nitrate	9	-7	-0.63	0.544	-0.19
SC-262	Nitrate	9	1	0.00	1.000	0.03
SC-262	Nitrate	5	6	1.22	0.234	0.60
SC-28	Nitrate	8	0	0.00	1.000	0.00
SC-3	Nitrate	4	0	0.00	1.000	0.00
SC-30	Nitrate	9	-14	-1.36	0.180	-0.39
SC-32	Nitrate	8	1	0.00	1.000	0.04
SC-33	Nitrate	5	-9	-1.96	0.050	-0.90
SC-34	Nitrate	9	-15	-1.46	0.150	-0.42
SC-37	Nitrate	4	0	0.00	1.000	0.00
SC-39	Nitrate	5	-4	-0.73	0.484	-0.40
SC-4	Nitrate	4	-1	0.00	1.000	-0.17
SC-40	Nitrate	5	0	0.00	1.000	0.00
SC-41	Nitrate	5	-5	-0.98	0.358	-0.50
SC-42	Nitrate	14	-27	-1.42	0.158	-0.30
SC-43	Nitrate	4	-5	-1.36	0.208	-0.83
SC-44	Nitrate	7	13	1.80	0.070	0.62
SC-45	Nitrate	5	0	0.00	1.000	0.00
SC-46	Nitrate	9	16	1.56	0.120	0.44
SC-47	Nitrate	9	-16	-1.56	0.120	-0.44
SC-48	Nitrate	27	82	1.69	0.092	0.23
SC-49	Nitrate	10	-1	0.00	1.000	-0.02
SC-5	Nitrate	5	0	0.00	1.000	0.00
SC-57	Nitrate	9	6	0.52	0.612	0.17
SC-58	Nitrate	11	14	1.01	0.320	0.25
SC-59	Nitrate	10	-7	-0.54	0.600	-0.16
SC-6	Nitrate	6	3	0.38	0.720	0.20
SC-60	Nitrate	20	37	1.17	0.246	0.19
SC-61	Nitrate	10	7	0.54	0.600	0.16
SC-62	Nitrate	5	3	0.49	0.650	0.30

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-64	Nitrate	4	6	1.70	0.084	1.00
SC-65	Nitrate	24	-50	-1.22	0.226	-0.18
SC-66	Nitrate	8	0	0.00	1.000	0.00
SC-67	Nitrate	6	0	0.00	1.154	0.00
SC-68	Nitrate	8	-2	-0.12	0.904	-0.07
SC-69	Nitrate	7	1	0.00	1.000	0.05
SC-7	Nitrate	10	9	0.72	0.484	0.20
SC-71	Nitrate	32	-70	-1.12	0.266	-0.14
SC-72	Nitrate	7	4	0.45	0.666	0.19
SC-73	Nitrate	4	0	0.00	1.000	0.00
SC-74	Nitrate	5	0	0.00	1.000	0.00
SC-75	Nitrate	13	-9	-0.49	0.632	-0.12
SC-76	Nitrate	12	-25	-1.65	0.100	-0.38
SC-77	Nitrate	5	2	0.24	0.816	0.20
SC-78	Nitrate	15	-3	-0.10	0.922	-0.03
SC-79	Nitrate	11	-3	-0.16	0.880	-0.05
SC-8	Nitrate	7	-3	-0.30	0.772	-0.14
SC-80	Nitrate	7	-1	0.00	1.000	-0.05
SC-82	Nitrate	7	10	1.35	0.186	0.48
SC-83	Nitrate	8	16	1.86	0.062	0.57
SC-84	Nitrate	7	1	0.00	1.000	0.05
SC-85	Nitrate	7	7	0.90	0.382	0.33
SC-86	Nitrate	5	0	0.00	1.000	0.00
SC-87	Nitrate	5	2	0.24	0.816	0.20
SC-88	Nitrate	5	4	0.73	0.484	0.40
SC-89	Nitrate	6	9	1.50	0.136	0.60
SC-9	Nitrate	8	-2	-0.12	0.904	-0.07
SC-90	Nitrate	8	8	0.87	0.398	0.29
SC-92	Nitrate	8	16	1.86	0.062	0.57
SC-93	Nitrate	9	9	0.83	0.416	0.25
SC-94	Nitrate	16	11	0.45	0.658	0.09
SC-95	Nitrate	9	-18	-1.77	0.076	-0.50
SC-98	Nitrate	15	16	0.74	0.466	0.15
SC-99	Nitrate	8	8	0.87	0.398	0.29
SC-1	TDS	6	3	0.38	0.720	0.20
SC-10	TDS	4	-1	0.00	1.000	-0.17
SC-103	TDS	5	-4	-0.73	0.484	-0.40
SC-104	TDS	4	2	0.34	0.750	0.33
SC-106	TDS	8	-8	-0.87	0.398	-0.29
SC-107	TDS	6	1	0.00	1.000	0.07
SC-108	TDS	5	-1	0.00	1.000	-0.10
SC-109	TDS	6	-5	-0.75	0.470	-0.33
SC-11	TDS	6	-2	-0.19	0.860	-0.13
SC-110	TDS	5	-2	-0.24	0.816	-0.20
SC-121	TDS	4	0	0.00	1.000	0.00
SC-124	TDS	5	-2	-0.24	0.816	-0.20
SC-125	TDS	4	0	0.00	1.000	0.00
SC-127	TDS	5	2	0.24	0.816	0.20
SC-130	TDS	5	8	1.71	0.084	0.80
SC-131	TDS	4	1	0.00	1.000	0.17
SC-132	TDS	5	3	0.49	0.650	0.30

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-133	TDS	4	0	0.00	1.000	0.00
SC-134	TDS	4	-1	0.00	1.000	-0.17
SC-137	TDS	4	0	0.00	1.000	0.00
SC-140	TDS	4	-3	-0.68	0.542	-0.50
SC-141	TDS	4	-1	0.00	1.000	-0.17
SC-142	TDS	7	6	0.75	0.472	0.29
SC-143	TDS	4	4	1.02	0.334	0.67
SC-147	TDS	4	0	0.00	1.000	0.00
SC-148	TDS	4	3	0.68	0.542	0.50
SC-149	TDS	4	0	0.00	1.000	0.00
SC-15	TDS	9	-2	-0.10	0.920	-0.06
SC-150	TDS	4	0	0.00	1.000	0.00
SC-151	TDS	4	6	1.70	0.084	1.00
SC-157	TDS	4	0	0.00	1.000	0.00
SC-159	TDS	4	-2	-0.34	0.750	-0.33
SC-164	TDS	4	-1	0.00	1.000	-0.17
SC-166	TDS	5	2	0.24	0.816	0.20
SC-167	TDS	8	-11	-1.24	0.226	-0.39
SC-17	TDS	4	-6	-1.70	0.084	-1.00
SC-170	TDS	4	2	0.34	0.750	0.33
SC-176	TDS	4	-2	-0.34	0.750	-0.33
SC-177	TDS	4	2	0.34	0.750	0.33
SC-18	TDS	8	-8	-0.87	0.398	-0.29
SC-182	TDS	4	4	1.02	0.334	0.67
SC-183	TDS	4	0	0.00	1.000	0.00
SC-185	TDS	4	0	0.00	1.000	0.00
SC-190	TDS	6	0	0.00	1.154	0.00
SC-191	TDS	4	-4	-1.02	0.334	-0.67
SC-193	TDS	4	2	0.34	0.750	0.33
SC-197	TDS	4	-2	-0.34	0.750	-0.33
SC-198	TDS	4	2	0.34	0.750	0.33
SC-199	TDS	5	-4	-0.73	0.484	-0.40
SC-201	TDS	6	0	0.00	1.154	0.00
SC-202	TDS	4	6	1.70	0.084	1.00
SC-203	TDS	4	-4	-1.02	0.334	-0.67
SC-205	TDS	4	4	1.02	0.334	0.67
SC-206	TDS	6	3	0.38	0.720	0.20
SC-207	TDS	5	-2	-0.24	0.816	-0.20
SC-208	TDS	6	1	0.00	1.000	0.07
SC-209	TDS	4	0	0.00	1.000	0.00
SC-210	TDS	6	-1	0.00	1.000	-0.07
SC-211	TDS	5	0	0.00	1.000	0.00
SC-212	TDS	6	5	0.75	0.470	0.33
SC-219	TDS	4	2	0.34	0.750	0.33
SC-225	TDS	4	-3	-0.68	0.542	-0.50
SC-226	TDS	7	4	0.45	0.666	0.19
SC-228	TDS	4	4	1.02	0.334	0.67
SC-232	TDS	7	3	0.30	0.772	0.14
SC-235	TDS	4	4	1.02	0.334	0.67
SC-244	TDS	4	-4	-1.02	0.334	-0.67
SC-245	TDS	4	-4	-1.02	0.334	-0.67

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-246	TDS	5	-9	-1.96	0.050	-0.90
SC-247	TDS	4	-4	-1.02	0.334	-0.67
SC-249	TDS	5	-5	-0.98	0.358	-0.50
SC-250	TDS	4	-6	-1.70	0.084	-1.00
SC-252	TDS	4	2	0.34	0.750	0.33
SC-254	TDS	8	13	1.48	0.142	0.46
SC-257	TDS	4	0	0.00	1.000	0.00
SC-258	TDS	4	0	0.00	1.000	0.00
SC-259	TDS	4	-6	-1.70	0.084	-1.00
SC-26	TDS	5	-9	-1.96	0.050	-0.90
SC-260	TDS	4	2	0.34	0.750	0.33
SC-262	TDS	5	6	1.22	0.234	0.60
SC-3	TDS	4	-4	-1.02	0.334	-0.67
SC-30	TDS	5	-8	-1.71	0.084	-0.80
SC-32	TDS	8	-4	-0.37	0.720	-0.14
SC-33	TDS	5	0	0.00	1.000	0.00
SC-34	TDS	6	-1	0.00	1.000	-0.07
SC-37	TDS	5	-8	-1.71	0.084	-0.80
SC-38	TDS	4	-6	-1.70	0.084	-1.00
SC-39	TDS	6	-7	-1.13	0.272	-0.47
SC-4	TDS	4	-6	-1.70	0.084	-1.00
SC-40	TDS	6	-10	-1.69	0.096	-0.67
SC-41	TDS	5	-2	-0.24	0.816	-0.20
SC-45	TDS	5	-2	-0.24	0.816	-0.20
SC-46	TDS	9	-5	-0.42	0.686	-0.14
SC-47	TDS	9	-12	-1.15	0.260	-0.33
SC-48	TDS	6	-3	-0.38	0.720	-0.20
SC-5	TDS	5	-3	-0.49	0.650	-0.30
SC-51	TDS	9	-4	-0.31	0.762	-0.11
SC-54	TDS	4	4	1.02	0.334	0.67
SC-55	TDS	9	-13	-1.25	0.220	-0.36
SC-56	TDS	6	11	1.88	0.056	0.73
SC-57	TDS	4	-3	-0.68	0.542	-0.50
SC-6	TDS	6	5	0.75	0.470	0.33
SC-60	TDS	4	2	0.34	0.750	0.33
SC-61	TDS	7	10	1.35	0.186	0.48
SC-62	TDS	5	-3	-0.49	0.650	-0.30
SC-63	TDS	7	-4	-0.45	0.666	-0.19
SC-66	TDS	8	-5	-0.49	0.634	-0.18
SC-75	TDS	8	-10	-1.11	0.276	-0.36
SC-78	TDS	4	-1	0.00	1.000	-0.17
SC-79	TDS	4	0	0.00	1.000	0.00
SC-80	TDS	4	4	1.02	0.334	0.67
SC-82	TDS	4	-4	-1.02	0.334	-0.67
SC-83	TDS	6	-9	-1.50	0.136	-0.60
SC-85	TDS	4	2	0.34	0.750	0.33
SC-86	TDS	6	-1	0.00	1.000	-0.07
SC-87	TDS	6	9	1.50	0.136	0.60
SC-88	TDS	5	4	0.73	0.484	0.40
SC-89	TDS	6	7	1.13	0.272	0.47
SC-9	TDS	4	-2	-0.34	0.750	-0.33

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Santa Clara Subbasin - Santa Clara Plain (continued)						
SC-90	TDS	8	-14	-1.61	0.108	-0.50
SC-91	TDS	6	7	1.13	0.272	0.47
SC-93	TDS	4	-2	-0.34	0.750	-0.33
SC-98	TDS	4	2	0.34	0.750	0.33
Santa Clara Subbasin - Coyote Valley						
C-10	Chloride	5	8	1.71	0.084	0.80
C-13	Chloride	7	0	0.00	1.000	0.00
C-16	Chloride	9	-4	-0.31	0.762	-0.11
C-18	Chloride	5	1	0.00	1.000	0.10
C-20	Chloride	5	4	0.73	0.484	0.40
C-21	Chloride	5	-6	-1.22	0.234	-0.60
C-22	Chloride	5	1	0.00	1.000	0.10
C-24	Chloride	8	-2	-0.12	0.904	-0.07
C-25	Chloride	5	0	0.00	1.000	0.00
C-26	Chloride	5	4	0.73	0.484	0.40
C-4	Chloride	4	4	1.02	0.334	0.67
C-6	Chloride	7	9	1.20	0.238	0.43
C-9	Chloride	5	6	1.22	0.234	0.60
C-1	Nitrate	5	-7	-1.47	0.158	-0.70
C-11	Nitrate	5	8	1.71	0.084	0.80
C-12	Nitrate	6	-3	-0.38	0.720	-0.20
C-13	Nitrate	7	-1	0.00	1.000	-0.05
C-16	Nitrate	12	6	0.34	0.738	0.09
C-2	Nitrate	7	-8	-1.05	0.310	-0.38
C-20	Nitrate	10	-13	-1.07	0.292	-0.29
C-22	Nitrate	5	0	0.00	1.000	0.00
C-23	Nitrate	7	5	0.60	0.562	0.24
C-24	Nitrate	12	-9	-0.55	0.592	-0.14
C-3	Nitrate	8	1	0.00	1.000	0.04
C-4	Nitrate	8	-14	-1.61	0.108	-0.50
C-5	Nitrate	7	-3	-0.30	0.772	-0.14
C-7	Nitrate	7	-3	-0.30	0.772	-0.14
C-8	Nitrate	21	-38	-1.12	0.268	-0.18
C-9	Nitrate	5	-6	-1.22	0.234	-0.60
L-6	Nitrate	38	157	1.96	0.050	0.22
SC-261	Nitrate	8	-11	-1.24	0.226	-0.39
C-10	TDS	5	4	0.73	0.484	0.40
C-13	TDS	7	5	0.60	0.562	0.24
C-16	TDS	9	-12	-1.15	0.260	-0.33
C-18	TDS	5	2	0.24	0.816	0.20
C-20	TDS	5	1	0.00	1.000	0.10
C-21	TDS	5	0	0.00	1.000	0.00
C-22	TDS	5	2	0.24	0.816	0.20
C-24	TDS	8	6	0.62	0.548	0.21
C-25	TDS	5	0	0.00	1.000	0.00
C-26	TDS	5	-4	-0.73	0.484	-0.40
C-4	TDS	4	1	0.00	1.000	0.17
C-9	TDS	5	3	0.49	0.650	0.30
Llagas Subbasin						
L-10	Chloride	5	8	1.71	0.084	0.80
L-101	Chloride	4	-2	-0.34	0.750	-0.33

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Llagas Subbasin (continued)						
L-102	Chloride	9	11	1.04	0.308	0.31
L-103	Chloride	5	-1	0.00	1.000	-0.10
L-104	Chloride	4	2	0.34	0.750	0.33
L-105	Chloride	11	0	0.00	1.000	0.00
L-106	Chloride	4	0	0.00	1.000	0.00
L-107	Chloride	8	-4	-0.37	0.720	-0.14
L-108	Chloride	4	4	1.02	0.334	0.67
L-11	Chloride	5	6	1.22	0.234	0.60
L-117	Chloride	5	0	0.00	1.000	0.00
L-118	Chloride	6	1	0.00	1.000	0.07
L-119	Chloride	6	-3	-0.38	0.720	-0.20
L-12	Chloride	5	4	0.73	0.484	0.40
L-13	Chloride	5	2	0.24	0.816	0.20
L-14	Chloride	5	5	0.98	0.358	0.50
L-20	Chloride	4	0	0.00	1.000	0.00
L-21	Chloride	6	11	1.88	0.056	0.73
L-22	Chloride	7	-2	-0.15	0.886	-0.10
L-23	Chloride	5	1	0.00	1.000	0.10
L-26	Chloride	5	9	1.96	0.050	0.90
L-27	Chloride	5	6	1.22	0.234	0.60
L-28	Chloride	6	11	1.88	0.056	0.73
L-32	Chloride	8	10	1.11	0.276	0.36
L-35	Chloride	7	2	0.15	0.886	0.10
L-4	Chloride	7	2	0.15	0.886	0.10
L-41	Chloride	7	2	0.15	0.886	0.10
L-44	Chloride	4	1	0.00	1.000	0.17
L-47	Chloride	4	0	0.00	1.000	0.00
L-53	Chloride	7	5	0.60	0.562	0.24
L-55	Chloride	4	0	0.00	1.000	0.00
L-58	Chloride	4	-2	-0.34	0.750	-0.33
L-60	Chloride	4	5	1.36	0.208	0.83
L-62	Chloride	5	6	1.22	0.234	0.60
L-66	Chloride	8	8	0.87	0.398	0.29
L-68	Chloride	7	12	1.65	0.102	0.57
L-7	Chloride	6	3	0.38	0.720	0.20
L-70	Chloride	8	5	0.49	0.634	0.18
L-71	Chloride	6	2	0.19	0.860	0.13
L-76	Chloride	4	6	1.70	0.084	1.00
L-79	Chloride	5	0	0.00	1.000	0.00
L-8	Chloride	4	5	1.36	0.208	0.83
L-80	Chloride	4	-1	0.00	1.000	-0.17
L-81	Chloride	8	-15	-1.73	0.084	-0.54
L-84	Chloride	9	10	0.94	0.358	0.28
L-9	Chloride	5	6	1.22	0.234	0.60
L-94	Chloride	4	1	0.00	1.000	0.17
B-3	Nitrate	11	-26	-1.95	0.050	-0.47
L-100	Nitrate	8	1	0.00	1.000	0.04
L-101	Nitrate	11	11	0.78	0.446	0.20
L-102	Nitrate	9	4	0.31	0.762	0.11
L-103	Nitrate	5	0	0.00	1.000	0.00
L-104	Nitrate	12	-1	0.00	1.000	-0.02

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Llagas Subbasin(continued)						
L-105	Nitrate	15	38	1.83	0.066	0.36
L-106	Nitrate	4	6	1.70	0.084	1.00
L-107	Nitrate	12	-8	-0.48	0.638	-0.12
L-108	Nitrate	4	4	1.02	0.334	0.67
L-109	Nitrate	4	-4	-1.02	0.334	-0.67
L-110	Nitrate	9	7	0.63	0.544	0.19
L-111	Nitrate	10	-16	-1.34	0.186	-0.36
L-112	Nitrate	9	-1	0.00	1.000	-0.03
L-115	Nitrate	9	0	0.00	1.000	0.00
L-116	Nitrate	16	-18	-0.77	0.450	-0.15
L-117	Nitrate	11	-3	-0.16	0.880	-0.05
L-118	Nitrate	6	-1	0.00	1.000	-0.07
L-119	Nitrate	6	-8	-1.32	0.204	-0.53
L-12	Nitrate	10	-9	-0.72	0.484	-0.20
L-120	Nitrate	8	-4	-0.37	0.720	-0.14
L-121	Nitrate	8	-1	0.00	1.000	-0.04
L-122	Nitrate	5	0	0.00	1.000	0.00
L-123	Nitrate	10	16	1.34	0.186	0.36
L-124	Nitrate	6	-1	0.00	1.000	-0.07
L-125	Nitrate	7	0	0.00	1.000	0.00
L-126	Nitrate	10	-15	-1.25	0.216	-0.33
L-127	Nitrate	6	-2	-0.19	0.860	-0.13
L-128	Nitrate	28	-95	-1.86	0.062	-0.25
L-129	Nitrate	31	-81	-1.36	0.176	-0.17
L-13	Nitrate	10	-6	-0.45	0.664	-0.13
L-130	Nitrate	8	-7	-0.74	0.472	-0.25
L-131	Nitrate	6	-7	-1.13	0.272	-0.47
L-132	Nitrate	6	-4	-0.56	0.594	-0.27
L-14	Nitrate	10	0	0.00	1.000	0.00
L-16	Nitrate	19	-1	0.00	1.000	-0.01
L-17	Nitrate	15	13	0.59	0.558	0.12
L-18	Nitrate	10	-17	-1.43	0.156	-0.38
L-19	Nitrate	27	-14	-0.27	0.788	-0.04
L-20	Nitrate	8	-7	-0.74	0.472	-0.25
L-23	Nitrate	9	-17	-1.67	0.098	-0.47
L-25	Nitrate	7	-13	-1.80	0.070	-0.62
L-26	Nitrate	12	18	1.17	0.250	0.27
L-27	Nitrate	9	-6	-0.52	0.612	-0.17
L-3	Nitrate	10	-9	-0.72	0.484	-0.20
L-31	Nitrate	11	-4	-0.23	0.820	-0.07
L-32	Nitrate	8	10	1.11	0.276	0.36
L-35	Nitrate	7	-3	-0.30	0.772	-0.14
L-36	Nitrate	5	-6	-1.22	0.234	-0.60
L-37	Nitrate	12	22	1.44	0.152	0.33
L-38	Nitrate	5	-3	-0.49	0.650	-0.30
L-39	Nitrate	10	-19	-1.61	0.108	-0.42
L-40	Nitrate	12	-5	-0.27	0.788	-0.08
L-41	Nitrate	7	-11	-1.50	0.136	-0.52
L-42	Nitrate	11	-5	-0.31	0.762	-0.09
L-44	Nitrate	11	-25	-1.87	0.060	-0.45
L-45	Nitrate	9	-10	-0.94	0.358	-0.28

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Llagas Subbasin (continued)						
L-46	Nitrate	9	0	0.00	1.000	0.00
L-47	Nitrate	10	9	0.72	0.484	0.20
L-48	Nitrate	11	-3	-0.16	0.880	-0.05
L-49	Nitrate	7	6	0.75	0.472	0.29
L-50	Nitrate	8	15	1.73	0.084	0.54
L-51	Nitrate	7	-5	-0.60	0.562	-0.24
L-52	Nitrate	9	-7	-0.63	0.544	-0.19
L-53	Nitrate	7	5	0.60	0.562	0.24
L-54	Nitrate	8	-8	-0.87	0.398	-0.29
L-55	Nitrate	11	-12	-0.86	0.402	-0.22
L-58	Nitrate	11	13	0.93	0.358	0.24
L-60	Nitrate	11	14	1.01	0.320	0.25
L-62	Nitrate	5	4	0.73	0.484	0.40
L-63	Nitrate	8	-2	-0.12	0.904	-0.07
L-64	Nitrate	7	11	1.50	0.136	0.52
L-65	Nitrate	24	-58	-1.41	0.158	-0.21
L-66	Nitrate	11	-10	-0.70	0.494	-0.18
L-67	Nitrate	7	7	0.90	0.382	0.33
L-68	Nitrate	11	20	1.48	0.142	0.36
L-69	Nitrate	5	0	0.00	1.000	0.00
L-70	Nitrate	13	30	1.77	0.076	0.38
L-71	Nitrate	6	0	0.00	1.154	0.00
L-72	Nitrate	15	34	1.63	0.102	0.32
L-73	Nitrate	10	11	0.89	0.380	0.24
L-74	Nitrate	10	3	0.18	0.862	0.07
L-75	Nitrate	10	9	0.72	0.484	0.20
L-76	Nitrate	11	15	1.09	0.282	0.27
L-77	Nitrate	9	-1	0.00	1.000	-0.03
L-78	Nitrate	37	124	1.61	0.108	0.19
L-79	Nitrate	9	18	1.77	0.076	0.50
L-82	Nitrate	4	-2	-0.34	0.750	-0.33
L-83	Nitrate	4	-2	-0.34	0.750	-0.33
L-84	Nitrate	13	28	1.65	0.100	0.36
L-88	Nitrate	37	-35	-0.44	0.658	-0.05
L-89	Nitrate	9	2	0.10	0.920	0.06
L-90	Nitrate	9	2	0.10	0.920	0.06
L-91	Nitrate	9	0	0.00	1.000	0.00
L-92	Nitrate	10	-10	-0.80	0.432	-0.22
L-93	Nitrate	11	-21	-1.56	0.120	-0.38
L-94	Nitrate	39	-161	-1.94	0.052	-0.22
L-95	Nitrate	10	1	0.00	1.000	0.02
L-97	Nitrate	10	-22	-1.88	0.058	-0.49
L-99	Nitrate	10	3	0.18	0.862	0.07
L-10	TDS	5	-4	-0.73	0.484	-0.40
L-101	TDS	4	-2	-0.34	0.750	-0.33
L-102	TDS	9	6	0.52	0.612	0.17
L-103	TDS	5	1	0.00	1.000	0.10
L-104	TDS	4	2	0.34	0.750	0.33
L-105	TDS	11	-4	-0.23	0.820	-0.07
L-106	TDS	4	-5	-1.36	0.208	-0.83
L-107	TDS	8	-2	-0.12	0.904	-0.07

Appendix E. Mann-Kendall Results for Wells with no Statistically Significant Concentration Trend, 2000 – 2009 (continued)

Masked Well ID	Constituent	n	S	z	P value	τ
Llagas Subbasin (continued)						
L-108	TDS	4	4	1.02	0.334	0.67
L-11	TDS	5	1	0.00	1.000	0.10
L-116	TDS	12	-8	-0.48	0.638	-0.12
L-117	TDS	5	6	1.22	0.234	0.60
L-118	TDS	6	-3	-0.38	0.720	-0.20
L-119	TDS	6	-9	-1.50	0.136	-0.60
L-12	TDS	5	0	0.00	1.000	0.00
L-13	TDS	5	0	0.00	1.000	0.00
L-14	TDS	5	-7	-1.47	0.158	-0.70
L-20	TDS	4	0	0.00	1.000	0.00
L-21	TDS	6	1	0.00	1.000	0.07
L-22	TDS	7	-3	-0.30	0.772	-0.14
L-23	TDS	5	3	0.49	0.650	0.30
L-26	TDS	5	-4	-0.73	0.484	-0.40
L-27	TDS	5	-1	0.00	1.000	-0.10
L-28	TDS	6	10	1.69	0.096	0.67
L-32	TDS	8	-1	0.00	1.000	-0.04
L-35	TDS	7	-1	0.00	1.000	-0.05
L-4	TDS	7	3	0.30	0.772	0.14
L-41	TDS	7	1	0.00	1.000	0.05
L-44	TDS	4	-4	-1.02	0.334	-0.67
L-47	TDS	4	-2	-0.34	0.750	-0.33
L-51	TDS	4	0	0.00	1.000	0.00
L-53	TDS	7	12	1.65	0.102	0.57
L-55	TDS	4	-2	-0.34	0.750	-0.33
L-58	TDS	4	0	0.00	1.000	0.00
L-60	TDS	4	5	1.36	0.208	0.83
L-62	TDS	5	2	0.24	0.816	0.20
L-66	TDS	8	0	0.00	1.000	0.00
L-68	TDS	7	1	0.00	1.000	0.05
L-7	TDS	6	4	0.56	0.594	0.27
L-70	TDS	9	16	1.56	0.120	0.44
L-71	TDS	6	5	0.75	0.470	0.33
L-76	TDS	4	2	0.34	0.750	0.33
L-79	TDS	5	-4	-0.73	0.484	-0.40
L-8	TDS	4	-6	-1.70	0.084	-1.00
L-81	TDS	9	-5	-0.42	0.686	-0.14
L-82	TDS	4	4	1.02	0.334	0.67
L-83	TDS	4	4	1.02	0.334	0.67
L-84	TDS	9	10	0.94	0.358	0.28
L-9	TDS	5	-5	-0.98	0.358	-0.50
L-94	TDS	4	4	1.02	0.334	0.67

Notes: n = number of data records; S = Mann-Kendall test statistic, z = Mann-Kendall statistic (S) converted to test statistic that is approximated by a normal distribution; *p* value = probability of getting the observed value of τ, or one more extreme, when the null hypothesis is true; τ = Kendall's tau (correlation coefficient).

Appendix F. Trend Testing Process

To evaluate potential trends, the simple (non-seasonal) Mann-Kendall test procedure was computed using MAROS (Monitoring and Remediation Optimization System) software, developed by the Air Force Center for Environmental Excellence

The simple (non-seasonal) Mann-Kendall test is a nonparametric test used to detect possible single direction trends in water quality constituents over time at individual well sites. Kendall's tau (τ) provides a measure of the strength of association between two continuous variables and a means to test the significance of that association. A test statistic is computed from the data then compared to zero. If the test statistic is unusually larger or smaller than zero, then the probability of trend in the data is high and trend is asserted. If the test statistic is approximately equal to zero, then a conclusion of "no trend" is reached. The direction in trend is measured by the sign of τ, with positive values indicating an upward trend and negative values indicating a downward trend in concentrations. The confidence level for this trend evaluation is equal to 95% ($\alpha=0.05$).

For sites having a statistically significant ($p < 0.05$) detectable trend, the magnitude of the trend is also estimated from the data pairs. The magnitude is actually the trend slope or rate at which concentration is increasing or decreasing over time. The slope is the median slope of all pair-wise comparisons of the concentration data. Each pair-wise difference in concentration is divided by the number of years separating them. For sites having significant detectable downward and upward trends, results of the trend testing procedure along with the magnitude of trend are presented in Appendix C and D, respectively.

Although the minimum requirements of the test procedure were met with respect to sample size, the data may have some limitations. For instance, the testing procedure will identify a statistically significant trend even though the change in concentration may be very small. Secondly, an ideal trend evaluation would have data collected at consistent and evenly spaced intervals for all wells.

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